United States
Department of
Agriculture

Soil
Conservation
Service

In cooperation with
Illinois Agricultural
Experiment Station

Soil Survey of Putnam County, Illinois

How To Use This Soil Survey

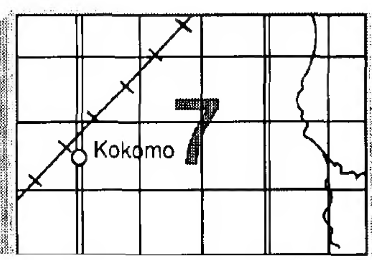
General Soil Map

The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

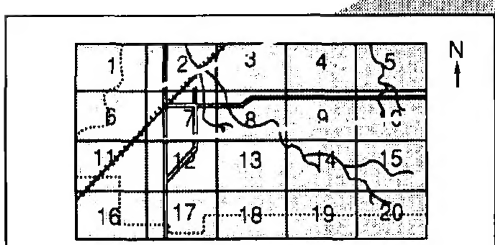
Detailed Soil Maps

The detailed soil maps follow the general soil map. These maps can be useful in planning the use and management of small areas.



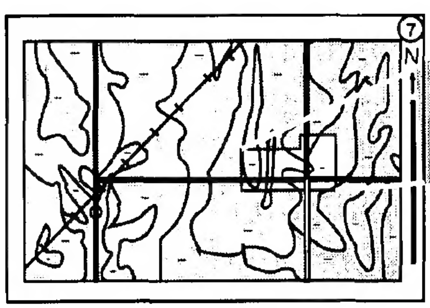
MAP SHEET

To find information about your area of interest, locate that area on the **Index to Map Sheets**, which precedes the soil maps. Note the number of the map sheet, and turn to that sheet.

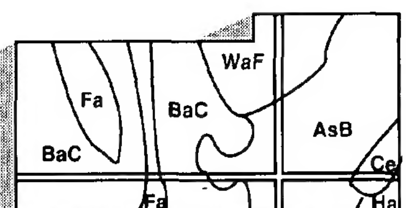


INDEX TO MAP SHEETS

Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Turn to the **Index to Map Units** (see Contents), which lists the map units by symbol and name and shows the page where each map unit is described.



MAP SHEET



AREA OF INTEREST

NOTE: Map unit symbols in a soil survey may consist only of numbers or letters, or they may be a combination of numbers and letters.

The **Summary of Tables** shows which table has data on a specific land use for each detailed soil map unit. See **Contents** for sections of this publication that may address your specific needs.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1986. Soil names and descriptions were approved in 1987. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1986. This survey was made cooperatively by the Soil Conservation Service and the Illinois Agricultural Experiment Station. The cost was shared by the Putnam County Board and the Illinois Department of Agriculture. The survey is part of the technical assistance furnished to the Marshall-Putnam County Soil and Water Conservation District.

This soil survey is Illinois Agricultural Experiment Station Soil Report No. 140.

Cover: A barge on the Illinois River at Hennepin.

Contents

Issued May 1992

Index to Map Units

Summary of Tables

Foreword

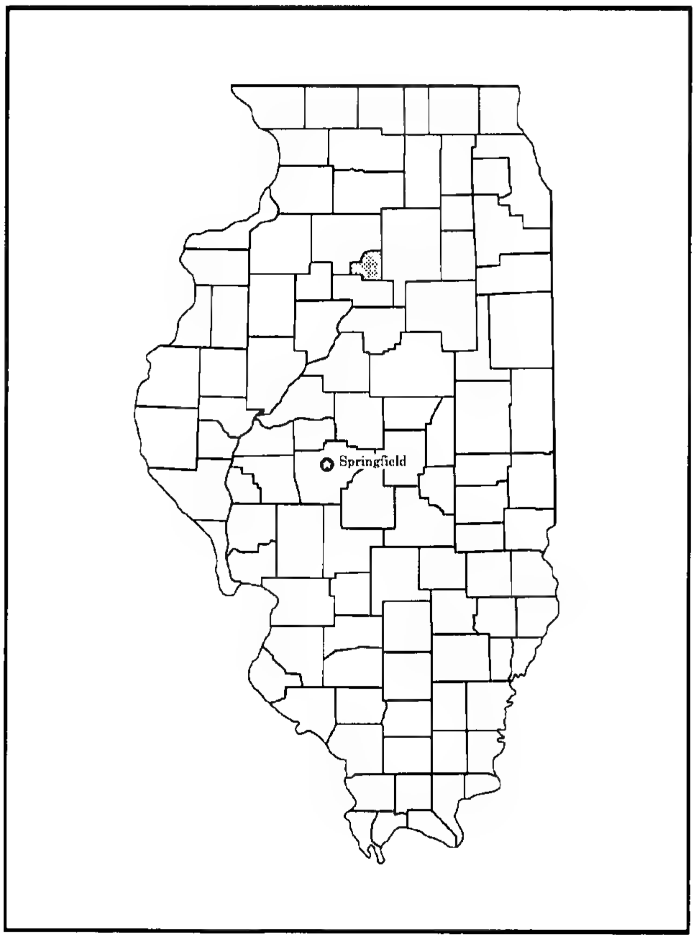
This soil survey contains information that can be used in land-planning programs in Putnam County. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

Charles Whitmore
State Conservationist
Soil Conservation Service



Location of Putnam County in Illinois.

Soil Survey of
Putnam County, Illinois

By Steven E. Zwicker, Soil Conservation Service

Fieldwork by Steven E. Zwicker, David B. Rahe, Samuel J. Indorante, and Michael J. Walczynski, Soil Conservation Service, and Bradley J. Cate and Clayton C. Heffter, Putnam County

United States Department of Agriculture, Soil Conservation Service, in cooperation with
the Illinois Agricultural Experiment Station

PUTNAM COUNTY is in the north-central part of the state at the big bend of the Illinois River. It has an area of about 110,080 acres, or 172 square miles. In 1980, the population of the county was about 6,089. Approximately one-fourth of the county is on the west side of the river, and three-fourths is on the east side. Hennepin, the county seat, is on the east bank of the river. It had a population of 716 in 1980.

This survey updates the soil survey of Putnam County published in 1937 *(10)*. It provides more recent information and larger maps, which show the soils in greater detail.

General Nature of the County

The western part of Putnam County is a glacial till plain. It is drained by Senachwine and Crow Creeks, which drain into the Illinois River. The Illinois River and associated flood plains and terraces are located in the central part of the county. Directly east of the terraces is a level to rolling landscape characterized by sand dunes. The eastern part of the county is a glacial till plain drained by Allforks, Coffee, and Clear Creeks. These creeks also drain into the Illinois River.

The soils in Putnam County vary widely in texture, natural drainage, and other characteristics. Those in the western part of the county are dominantly well drained and moderately well drained, gently sloping and sloping, and silty. Erosion is a hazard in these areas. Conservation measures help to control erosion and to prevent sedimentation. If properly managed, the soils are well suited to field crops, pasture, hay, and trees. They are suited to building site development.

The soils on the flood plains along the Illinois River dominantly are poorly drained, nearly level, and silty. Wetness and flooding are major concerns affecting the use of these soils. The poorly drained soils are well suited to field crops if drained. Because of the wetness and the flooding, these soils generally are poorly suited to most other uses.

Most of the soils on the terraces along the Illinois River are well drained, nearly level or gently sloping, and loamy. Erosion is a hazard in the gently sloping areas, and droughtiness is a limitation. The soils generally are well suited to field crops, pasture, hay, and trees. They are suited to building site development.

The soils in the eastern part of the county are mainly moderately well drained, somewhat poorly drained, or poorly drained, nearly level or gently sloping, and silty. Erosion is a major hazard affecting the use of the soils in the gently sloping areas, and wetness is a major limitation affecting the use of the somewhat poorly drained and poorly drained soils. Because of extensive conservation measures and tile drainage systems, these soils are well suited to field crops. Because of the wetness, however, the somewhat poorly drained and poorly drained soils are poorly suited to other uses.

The following paragraphs provide general information about Putnam County. They describe history and development, climate, farming, transportation facilities and industries, natural resources and water supply, and native vegetation.

History and Development

When Putnam County was organized in 1831, its boundaries also included the territory that now makes up the counties of Bureau, Stark, and Marshall. The dwellings of the first settler were erected in 1825 on the east bank of the Illinois River about 2 miles north of Hennepin. The population grew rapidly, and by 1870 it was about 6,300. It reached its peak between 1910 and 1920, when it was about 7,600 *(10)*.

Early agricultural development was enhanced by a relatively high percentage of prairie land bordering the narrow belt of timbered bluff land along the Illinois River. By 1880, more than half the area of the county was used for crops. Artificial drainage of the more nearly level prairie land and the construction of a levee along the Illinois River south of Hennepin produced more tillable land. In 1937, 89 percent of the county was farmed. The untillable areas included lakes, swampy bottom land, and steep bluff land.

In 1941, the Marshall-Putnam Soil and Water Conservation District was formed. The formation of the district allowed farmers to receive conservation technical assistance from the Soil Conservation Service.

Climate

Prepared by the Illinois State Water Survey, Champaign, Illinois.

Putnam County has a humid continental climate. It is hot in summer and cold in winter. In summer there are occasional cool spells. In winter precipitation falls as snow during frequent snowstorms. During the rest of the year, precipitation is chiefly rain showers, which often are heavy, when moist air moves in from the south. The annual rainfall usually is adequate for corn, soybeans, and small grain.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Ottawa in the period 1951 to 1980. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter, the average temperature is 27 degrees F and the average daily minimum temperature is 18.4 degrees. The lowest temperature on record, which occurred at Ottawa on January 1, 1963, is -21 degrees. In summer, the average temperature is about 74 degrees and the average daily maximum temperature is 85.1 degrees. The highest recorded temperature, which occurred at Ottawa on July 1, 1956, is 102 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is 34.79 inches. Of this, 22.73 inches, or 65 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 18 inches. The heaviest 1-day rainfall during the period of record was 8.77 inches at Ottawa on July 14, 1958. Thunderstorms occur on about 34 days each year.

The average seasonal snowfall is 28 inches. The greatest snow depth at any one time during the period of record was 28 inches. On the average, 44 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

Farming

Farming is the most important enterprise in the county. In 1982, a total of 84,630 acres was farmland *(9)*. About 69,232 acres was used for crops, including hay, pasture, and vegetable crops. The county had about 261 farms, and the average farm size was 324 acres.

Most of the acreage in the county is used to produce corn and soybeans. In 1982, about 41,434 acres of corn was harvested for grain and 21,296 acres of soybeans was harvested. In addition, 1,339 acres was used for wheat and 464 acres for oats. Hay was produced on 2,001 acres and pasture on 1,854 acres. The county also has small acreages of pumpkins, snap beans, popcorn, asparagus, and sweet corn.

Beef cattle and hogs are the major livestock enterprises in the county. Dairy cattle, chickens, sheep, and horses also are raised. The value of the livestock and the livestock products sold in the county is less than 25 percent of the value of the total agricultural products sold.

Transportation Facilities and Industries

The county is crossed by several U.S. and state highways. Interstate 180 and State Routes 29, 26, 89, 71, and 18 are the major highways. Secondary roads provide freight service throughout the county. Two railroads are in the county. The Illinois River is a major waterway for Putnam County as well as for the state as a whole.

The industrial enterprises in the county include steel, abrasives, and a power plant.

Natural Resources and Water Supply

Putnam County has an abundant supply of sand, gravel, and water. The most extensive sand and gravel deposits are the alluvial and terrace deposits along the Illinois River. The sand and gravel are used primarily as road material and for concrete aggregate.

The ground water in Putnam County is obtained from sand and gravel aquifers and bedrock aquifers *(4)*. The valley of the Illinois River is an excellent source of ground water because of the thick sand and gravel aquifers. Shallow Mississippian and Pennsylvanian bedrock aquifers extend throughout the county. They also are good sources of ground water.

Native Vegetation

Most of the native vegetation in the county has been destroyed. The area was dominated by prairie grasses, but areas along the Illinois River and its tributaries were dominated by forest vegetation. Rushes, cattails, and prairie cordgrass were in the swampy areas. The prairie areas of the sandy region of the county supported grasses, such as little bluestem, sand bluestem, sideoats grama, prairie dropseed, and prairie sandreed, and forbs, such as goat rue and prairie coreopsis. Common grasses in other areas were big bluestem, indiangrass, eastern gamagrass, and blue jointgrass, and common forbs were prairie dock and compassplant.

Trees native to the area are oaks, hickories, and maples. A few black walnut and elms are scattered throughout the county.

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; the kinds of crops and native plants growing on the soils; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

The soils in the survey area occur in an orderly pattern that is related to the geology, the landforms, relief, climate, and the natural vegetation of the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot

experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by several kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. These latter soils are called inclusions or included soils.

Most inclusions have properties and behavioral patterns similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting (similar) inclusions. They may or may not be mentioned in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps because of the scale used in mapping. The inclusions of contrasting soils are mentioned in the map unit descriptions. A few inclusions may not have been observed and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soil on the landscape.

The presence of inclusions in a map unit in no way diminishes the usefulness or accuracy of the soil data. The objective of soil mapping is not to delineate pure taxonomic classes of soils but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but onsite investigation is needed to plan for intensive uses in small areas.

General Soil Map Units

The general soil map at the back of this publication shows the soil associations in this survey area. Each association has a distinctive pattern of soils, relief, and drainage. Each is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

The general soil map of Putnam County joins the general soil maps of Bureau and La Salle Counties. Some of the names of the associations in these counties do not agree with those in Putnam County because of differences in the extent of the major soils in the associations or because of conceptual changes in the classification of the soils. The differences in the association names do not significantly affect the use of these maps for general planning.

Nearly Level Soils That Are Subject to Flooding

1. Moundprairie Association

Poorly drained, frequently flooded, silty soils that formed in alluvium; on flood plains

This association consists of soils on flood plains. Slopes range from 0 to 2 percent.

This association makes up about 9 percent of the county. It is about 70 percent Moundprairie soils and 30 percent minor soils (fig. 1).

Typically, the surface layer of the Moundprairie soils is mixed very dark gray and very dark grayish brown, friable, calcareous silty clay loam about 9 inches thick. The substratum extends to a buried soil at a depth of about 39 inches. It is mottled, friable, and calcareous. It is dominantly very dark gray silty clay loam, but the upper part has strata of very dark grayish brown sandy loam and silt loam. The buried soil to a depth of 60 inches or more is black, mottled, calcareous silty clay loam.

Minor in this association are Huntsville, Landes, and Terril soils. The well drained Landes and moderately well drained Huntsville soils are along stream tributaries and are slightly higher on the landscape than the Moundprairie soils. The well drained Terril soils are on foot slopes above the Moundprairie soils.

Most areas of this association are used as habitat for wetland wildlife. Drained areas are used for cultivated crops. This association is well suited to habitat for wetland wildlife. Where drained, it is moderately suited to cultivated crops. If these crops are grown, the seasonal high water table is a limitation and flooding is a hazard.

This association is generally unsuitable as a site for dwellings and septic tank absorption fields because of the flooding and the wetness.

2. Sawmill Association

Poorly drained, rarely flooded, silty soils that formed in alluvium; on flood plains

This association consists of soils on flood plains that are protected by levees. Slopes range from 0 to 2 percent.

This association makes up about 3 percent of the county. It is about 75 percent Sawmill soils and 25 percent minor soils.

Typically, the surface layer of the Sawmill soils is black, friable silty clay loam about 8 inches thick. The subsurface layer is black, mottled, firm silty clay loam about 15 inches thick. The subsoil is mottled, friable silty clay loam about 20 inches thick. The upper part is very dark gray. The lower part is dark gray. The substratum to a depth of 60 inches or more is dark gray, mottled, friable silty clay loam.

Minor in this association are the well drained Landes soils in the higher areas on the flood plains and the poorly drained Moundprairie soils in low areas that are subject to ponding.

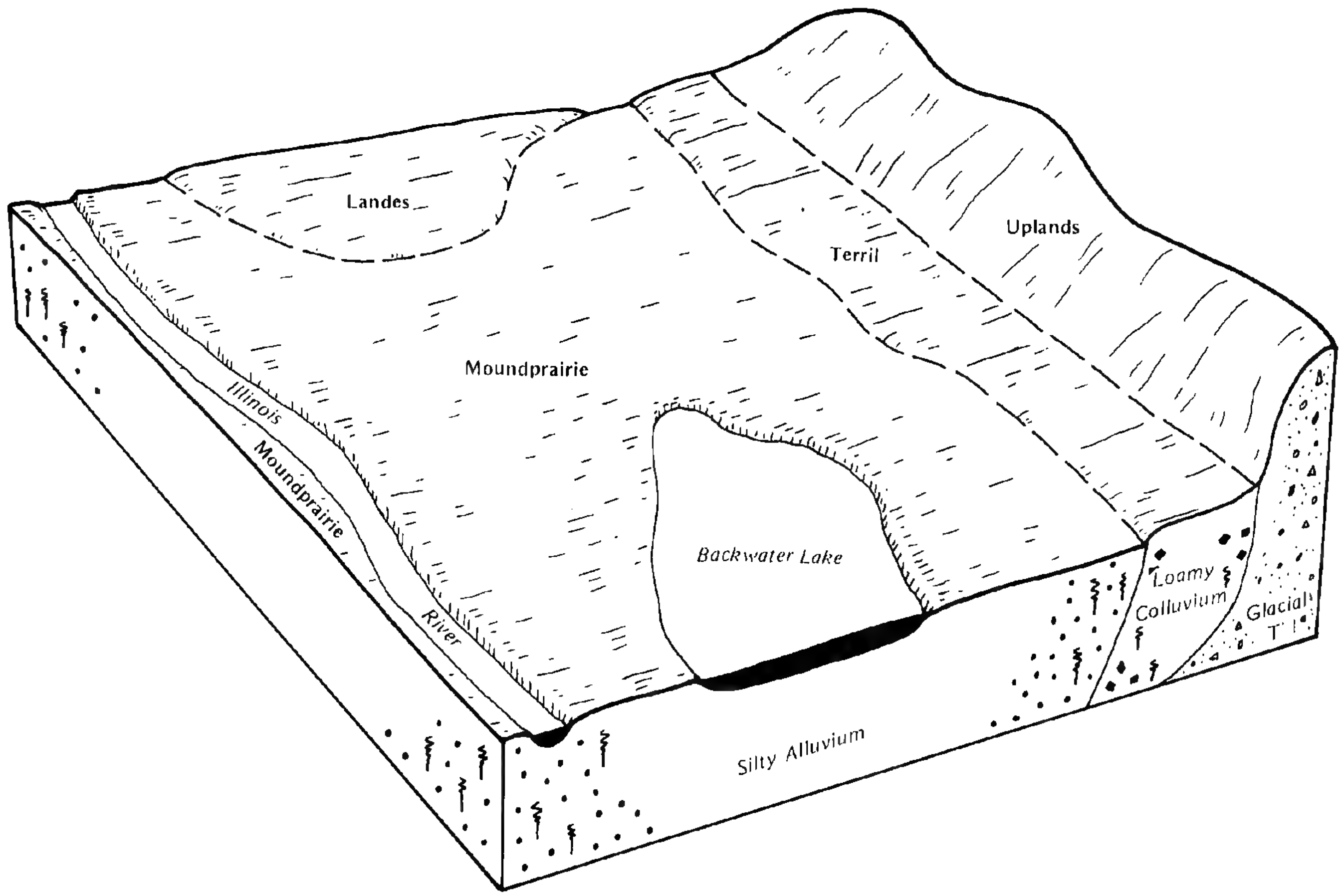


Figure 1.—Typical pattern of soils and parent material in the Moundprairie association.

Most areas of this association are cultivated. Because it is protected by levees from flooding, this association is well suited to cultivated crops. The seasonal high water table is a limitation.

This association is generally unsuitable as a site for dwellings and septic tank absorption fields because of the wetness and the flooding.

Nearly Level to Steep Soils That Are Subject to Soil Blowing, Water Erosion, or Both

3. Wea-Ade-Alvin Association

Well drained and somewhat excessively drained, silty, sandy, and loamy soils that formed in loamy sediments and the underlying sandy or gravelly material or in sandy eolian material or loamy sediments; on terraces and uplands

This association consists of soils on stream terraces and dunes. Slopes range from 0 to 30 percent.

This association makes up about 12 percent of the county. It is about 40 percent Wea and similar soils, 28 percent Ade and similar soils, 19 percent Alvin and similar soils, and 13 percent minor soils (fig. 2).

The well drained Wea soils are on nearly level and gently sloping stream terraces. Typically, the surface soil is very dark grayish brown, friable silt loam about 15 inches thick. The subsoil is about 28 inches thick. It is friable. The upper part is brown and dark brown clay loam. The lower part is dark brown gravelly clay loam and very gravelly loam. The substratum to a depth of 60 inches or more is dark brown, loose very gravelly sandy loam and brown, loose very gravelly loamy coarse sand.

The somewhat excessively drained Ade soils are on gently sloping to strongly sloping dunes. Typically, the surface layer is very dark grayish brown, very friable loamy fine sand about 10 inches thick. The subsurface layer is dark brown, very friable fine sand about 7 inches thick. The subsoil extends to a depth of more than 60 inches. The upper part is brown, very friable fine sand. The lower part is yellowish brown, loose fine sand that has bands of dark brown sandy loam and loamy sand.

The well drained Alvin soils are on gently sloping to

steep side slopes on stream terraces. Typically, the surface layer is very dark grayish brown, friable fine sandy loam about 4 inches thick. The subsurface layer is brown, friable fine sandy loam about 4 inches thick. The subsoil is about 36 inches thick. The upper part is dark yellowish brown, friable fine sandy loam and sandy loam. The next part is strong brown, friable sandy loam. The lower part is strong brown, loose loamy sand that has bands of sandy loam. The substratum to a depth of 60 inches or more is strong brown, loose loamy sand.

Minor in this association are the Huntsville, Littleton, Metea, Ridgeville, and Rodman soils, all of which are in areas below the major soils. The moderately well drained Huntsville soils are on flood plains. The somewhat poorly drained Littleton soils are on alluvial fans and stream terraces. The well drained Metea soils are on till plains above the major soils. The somewhat poorly drained Ridgeville soils are on terraces. The excessively drained Rodman soils are on terrace escarpments.

Most areas of this association are cultivated. Some are used as a source of sand and gravel. The nearly level and gently sloping Wea and Alvin soils are well suited to cultivated crops, the strongly sloping Alvin and gently sloping Ade soils are moderately suited, and the steep Alvin and strongly sloping Ade soils are generally unsuited. The major management concerns are water erosion, soil blowing, and droughtiness.

If this association is used as a site for buildings or septic tank absorption fields, the shrink-swell potential, the slope, a poor filtering capacity, and restricted permeability are management concerns.

Nearly Level to Sloping Soils That Are Subject to Water Erosion or Are Limited by Wetness

4. Catlin-Flanagan Association

Moderately well drained and somewhat poorly drained, silty soils that formed in loess and in the underlying glacial till; on uplands

This association consists of soils on moraines and glacial till plains. Slopes range from 0 to 10 percent.

This association makes up about 13 percent of the

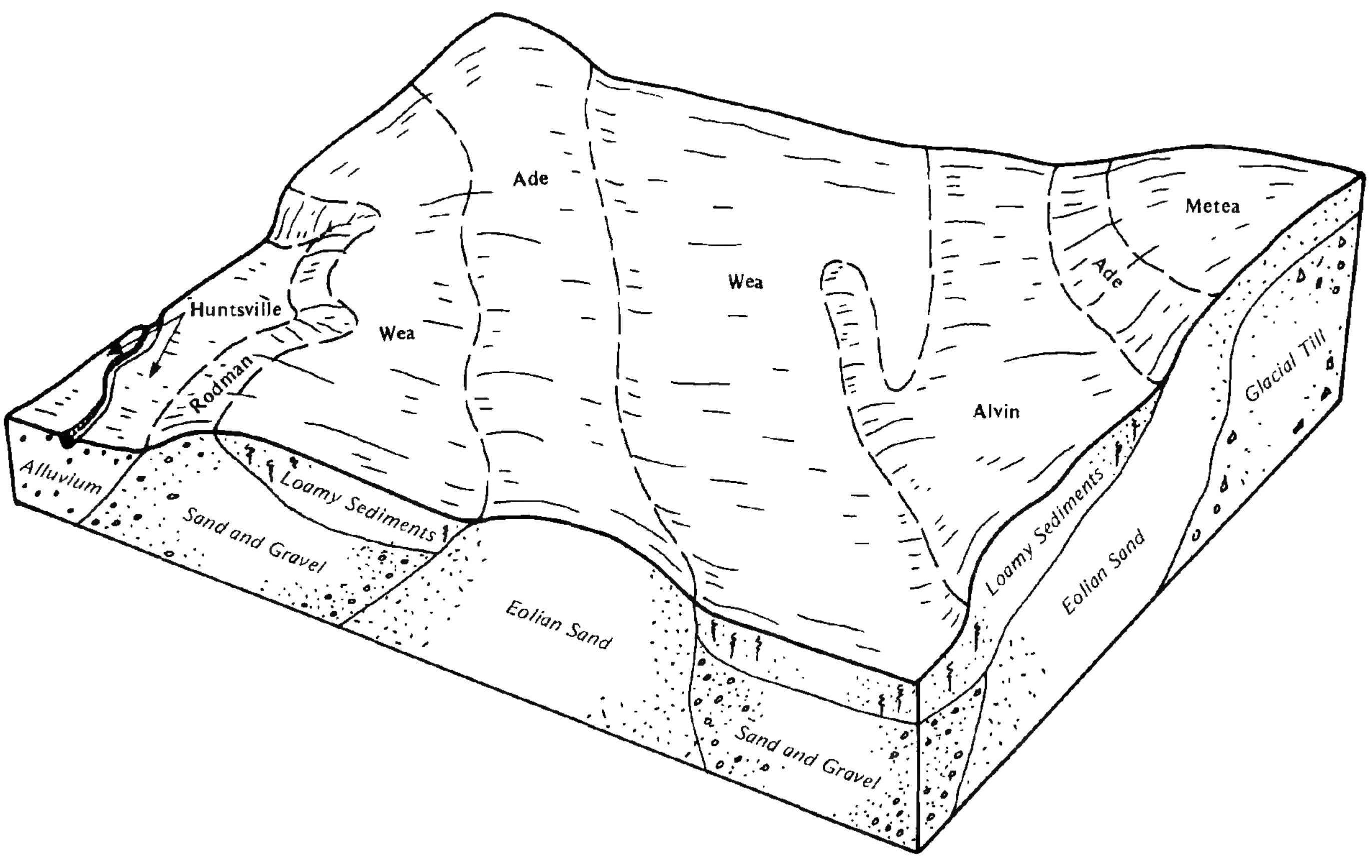


Figure 2.—Typical pattern of soils and parent material in the Wea-Ade-Alvin association.

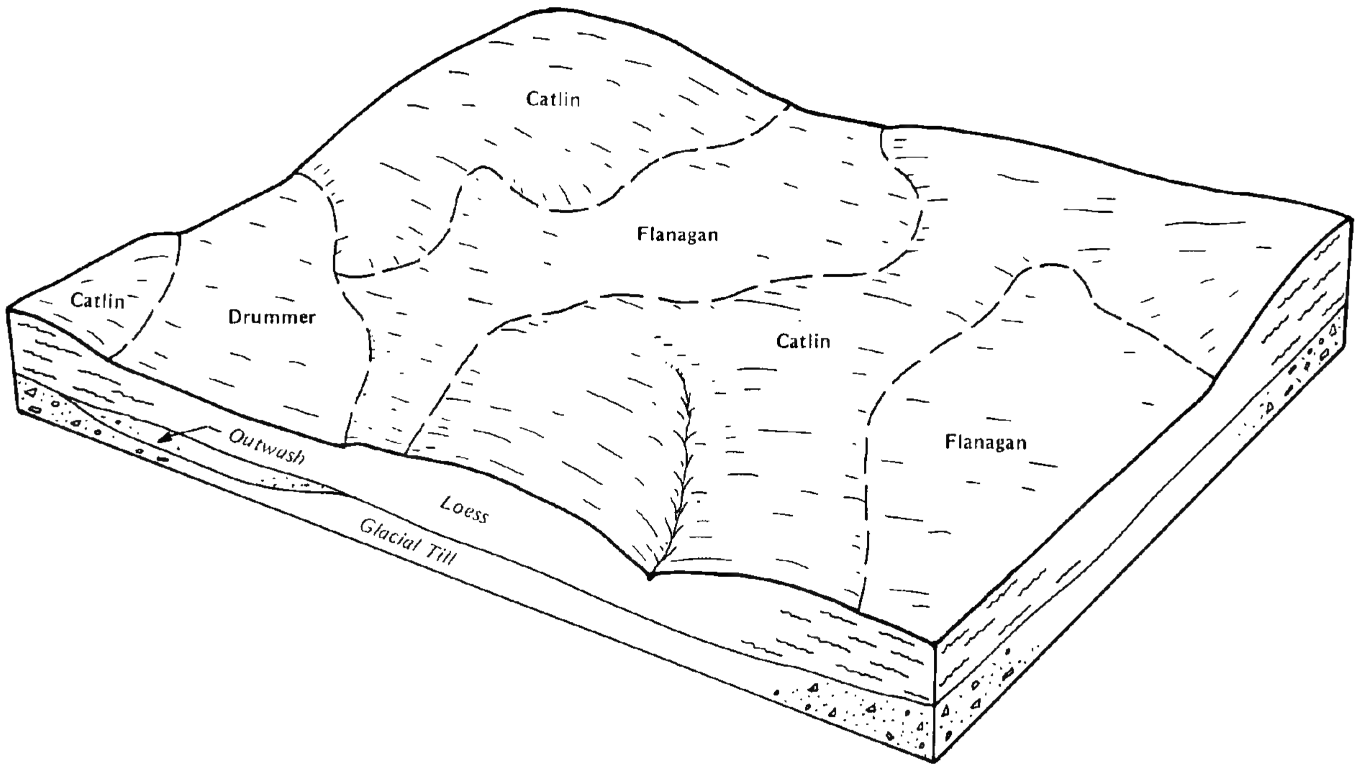


Figure 3.—Typical pattern of soils and parent material in the Catlin-Flanagan association.

county. It is about 62 percent Catlin soils, 17 percent Flanagan soils, and 21 percent minor soils (fig. 3).

The moderately well drained Catlin soils are on gently sloping ridges and sloping side slopes on glacial till plains and moraines. Typically, the surface layer is very dark grayish brown, friable silt loam about 7 inches thick. The subsurface layer is very dark grayish brown and very dark brown, friable silt loam about 5 inches thick. The subsoil is about 39 inches thick. The upper part is dark yellowish brown, friable silty clay loam. The next part is dark yellowish brown and brown, mottled, friable silty clay loam. The lower part is brown, mottled, friable silt loam. The substratum is brown, mottled, firm, calcareous silt loam.

The somewhat poorly drained Flanagan soils are on nearly level ridges on glacial till plains. Typically, the surface layer is black, friable silt loam about 9 inches thick. The subsurface layer is very dark grayish brown and black, friable silt loam about 8 inches thick. The subsoil extends to a depth of more than 60 inches. It is mottled. In sequence downward, it is dark grayish brown, friable silty clay loam; dark yellowish brown, friable and firm silty clay loam; light olive brown, friable silty clay loam; and light olive brown, calcareous, firm loam.

Minor in this association are the Drummer, Sawmill, and Varna soils. The poorly drained Drummer soils are on broad flats and in drainageways below the major soils. The poorly drained Sawmill soils are on flood plains below the major soils. The moderately well drained Varna soils are on knolls, ridgetops, and convex side slopes on the glacial till plains and moraines.

Most areas of this association are cultivated. The Flanagan soils and gently sloping areas of the Catlin soils are well suited to cultivated crops. The more sloping areas of the Catlin soils are moderately suited. The major management concerns are water erosion in areas of the Catlin soils and drainage in areas of the Flanagan soils.

If this association is used as a site for buildings or septic tank absorption fields, the shrink-swell potential, the wetness, and restricted permeability are management concerns.

5. Tama-Muscatine-Sable Association

Moderately well drained to poorly drained, silty soils that formed in loess; on uplands

This association consists of soils on glacial till plains. Slopes range from 0 to 10 percent.

This association makes up about 37 percent of the

county. It is about 33 percent Tama and similar soils, 32 percent Muscatine soils, 22 percent Sable soils, and 13 percent minor soils (fig. 4).

The moderately well drained Tama soils are in gently sloping and sloping areas. Typically, the surface layer is very dark brown, friable silt loam about 8 inches thick. The subsurface layer is very dark grayish brown, friable silt loam about 6 inches thick. The subsoil is about 43 inches thick. It is friable. The upper part is dark yellowish brown silty clay loam. The next part is dark yellowish brown, mottled silty clay loam. The lower part is dark yellowish brown, mottled silt loam. The substratum to a depth of 60 inches or more is dark yellowish brown, mottled, friable, calcareous silt loam.

The somewhat poorly drained Muscatine soils are in nearly level areas. Typically, the surface layer is black, friable silt loam about 8 inches thick. The subsurface layer is very dark grayish brown, friable silt loam about 6 inches thick. The subsoil is about 38 inches thick. It is friable. The upper part is very dark grayish brown silt loam. The next part is dark grayish brown silty clay loam. The lower part is grayish brown, mottled silty clay loam. The substratum to a depth of 60 inches or more is grayish brown, mottled, friable silt loam.

The poorly drained Sable soils are in nearly level areas that are lower than the Tama and Muscatine soils. Typically, the surface layer is black, friable silty clay loam about 9 inches thick. The subsurface layer is black, friable silty clay loam about 5 inches thick. The subsoil is about 33 inches thick. It is mottled and friable. The upper part is very dark gray silty clay loam. The next part is olive gray and light olive gray silty clay loam. The lower part is light olive gray silt loam. The substratum to a depth of 60 inches or more is light olive gray, mottled, friable, calcareous silt loam.

Minor in this association are the Harpster and Sawmill soils. The poorly drained Harpster soils are in landscape positions similar to those of the Sable soils.

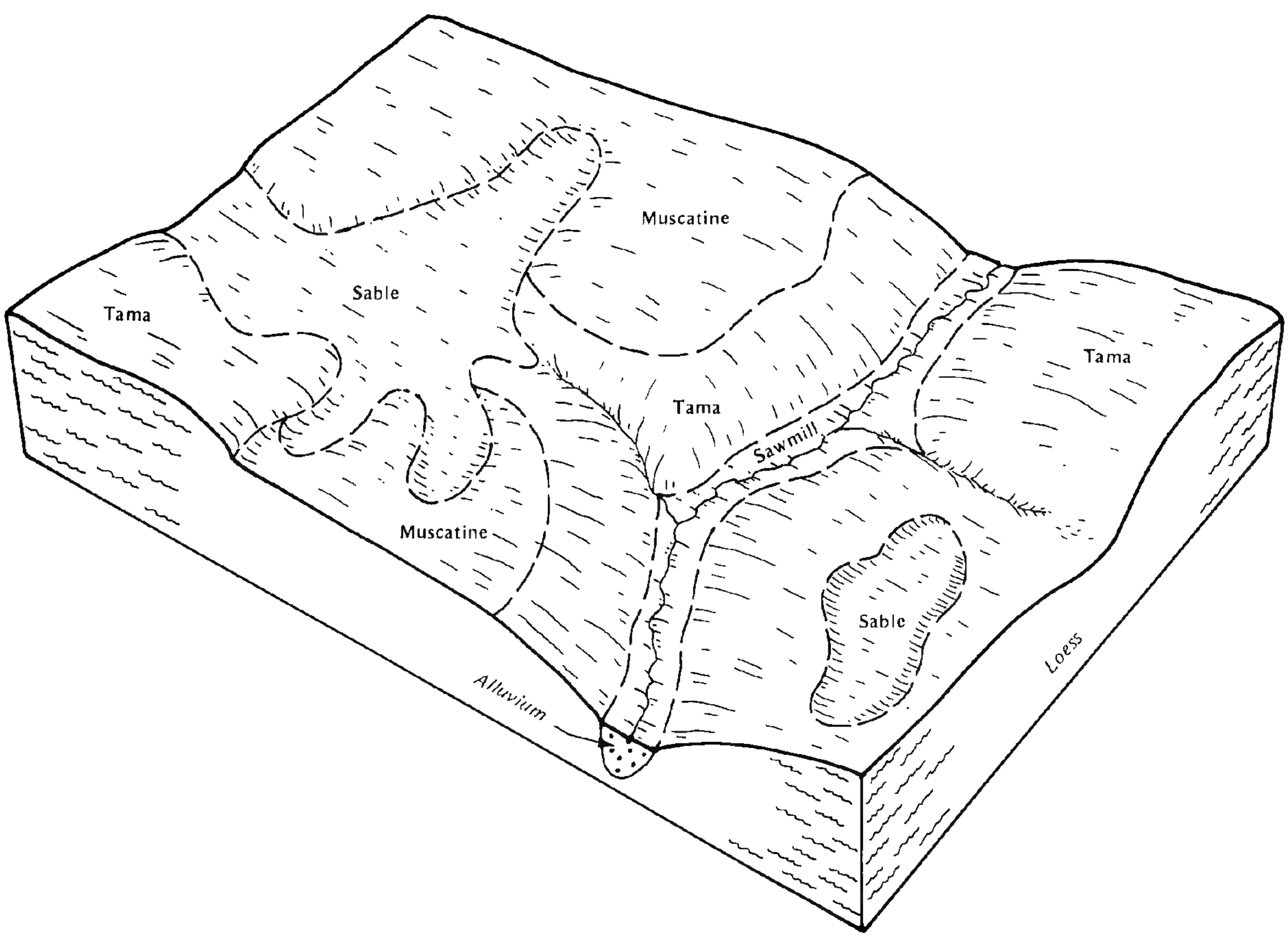


Figure 4.—Typical pattern of soils and parent material in the Tama-Muscatine-Sable association.

They are calcareous throughout. The poorly drained Sawmill soils are on flood plains below the major soils.

Most areas of this association are cultivated. The nearly level and gently sloping areas are well suited to cultivated crops. The sloping areas of Tama soils are moderately suited to cultivated crops. Maintaining or improving internal and surface drainage systems is the major management concern in the nearly level areas. In the gently sloping and sloping areas, water erosion is a management concern.

If this association is used as a site for buildings or septic tank absorption fields, the wetness, the shrink-swell potential, and ponding are management concerns.

Gently Sloping to Very Steep Soils That Are Subject to Water Erosion

6. Rozetta-Fayette-Miami Association

Gently sloping to steep, moderately well drained and well drained, silty and loamy soils that formed in loess or glacial till; on uplands

This association consists of soils on glacial till plains. Slopes range from 2 to 30 percent.

This association makes up about 6 percent of the county. It is about 42 percent Rozetta soils, 24 percent Fayette soils, 14 percent Miami soils, and 20 percent minor soils (fig. 5).

The moderately well drained Rozetta soils are in gently sloping areas. Typically, the surface layer is mixed dark brown and brown, friable silt loam about 9 inches thick. The subsoil extends to a depth of more than 60 inches. It is friable. The upper part is dark yellowish brown silty clay loam. The next part is dark yellowish brown, mottled silty clay loam. The lower part is yellowish brown, mottled silt loam.

The well drained Fayette soils are in sloping and strongly sloping areas. Typically, the surface layer is mixed dark grayish brown and yellowish brown, friable silt loam about 6 inches thick. The subsoil extends to a depth of more than 60 inches. It is yellowish brown and friable. The upper part is silty clay loam. The next part is mottled silty clay loam. The lower part is mottled silt loam.

The well drained Miami soils are in sloping to steep areas. Typically, the surface layer is brown, friable loam about 7 inches thick. The subsoil is about 31 inches thick. The upper part is dark yellowish brown, friable clay loam. The lower part is brown, firm clay loam. The substratum to a depth of 60 inches or more is brown, firm, calcareous clay loam.

Minor in this association are the Hennepin and Sawmill soils. The well drained Hennepin soils are on very steep side slopes along drainageways. They are calcareous throughout. The poorly drained Sawmill soils are in drainageways below the major soils.

Most areas of this association are cultivated. Some areas are wooded. The gently sloping areas are well suited to cultivated crops, and the more sloping areas are moderately suited. Water erosion is the major management concern in cultivated areas. Water erosion, soil compaction, and the slope, which restricts the use of equipment, are the major management concerns in the wooded areas.

If this association is used as a site for buildings or septic tank absorption fields, the shrink-swell potential, the slope, and the wetness are management concerns.

7. Hennepin-Miami-Morley Association

Sloping to very steep, well drained and moderately well drained, loamy and silty soils that formed in glacial till; on uplands

This association consists of soils on glacial till plains. Slopes range from 5 to 60 percent.

This association makes up about 11 percent of the county. It is about 40 percent Hennepin soils, 27 percent Miami soils, 20 percent Morley soils, and 13 percent minor soils (fig. 6).

The well drained Hennepin soils are in very steep areas. Typically, the surface layer is dark brown, friable loam about 4 inches thick. The subsoil is brown, friable, calcareous clay loam about 6 inches thick. The substratum to a depth of 60 inches or more is brown, friable, calcareous loam.

The well drained Miami soils are in sloping to steep areas. Typically, the surface layer is brown, friable loam about 7 inches thick. The subsoil is about 31 inches thick. The upper part is dark yellowish brown, friable clay loam. The lower part is brown, firm clay loam. The substratum to a depth of 60 inches or more is brown, firm, calcareous clay loam.

The moderately well drained and well drained Morley soils are in sloping to steep areas. Typically, the surface layer is very dark gray, friable silt loam about 3 inches thick. The subsurface layer is dark grayish brown, friable silt loam about 4 inches thick. The subsoil is about 30 inches thick. The upper part is dark grayish brown, friable silty clay loam. The next part is brown, firm silty clay loam. The lower part is brown and olive brown, mottled, firm, calcareous clay loam. The substratum to a depth of 60 inches or more is olive brown, mottled, very firm, calcareous clay loam.

Minor in this association are the Huntsville, Landes, Rodman, Rozetta, and Terril soils. The moderately well drained Huntsville and well drained Landes soils are on

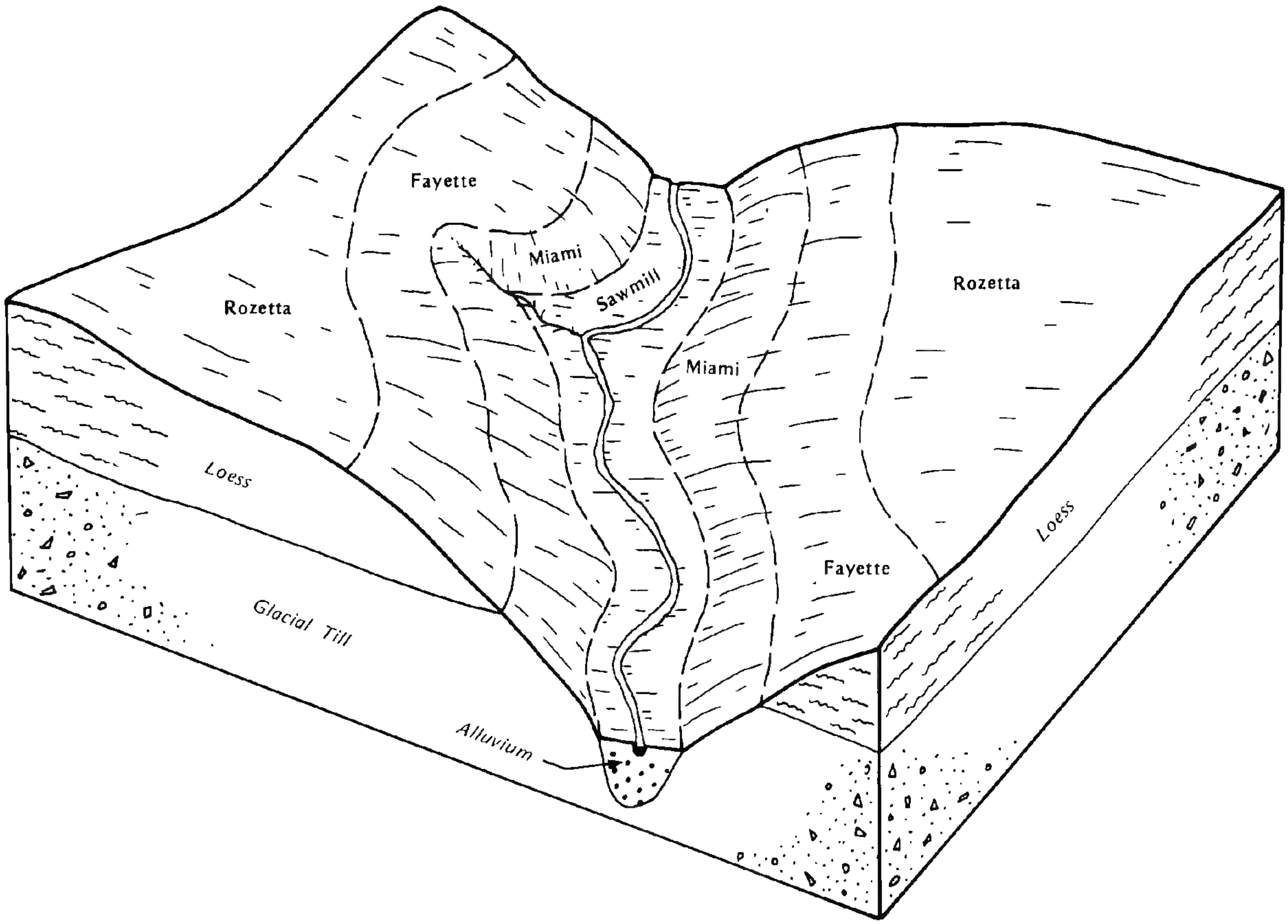


Figure 5.—Typical pattern of soils and parent material in the Rozetta-Fayette-Miami association.

flood plains. The excessively drained Rodman soils are on terrace escarpments below the major soils. The moderately well drained Rozetta soils are on ridges above the major soils. The well drained Terril soils are on foot slopes below the major soils.

Most areas of this association are used as woodland. Some areas are used for hay and pasture. The Miami soils are well suited to woodland. The Hennepin and Morley soils are moderately suited to woodland. The equipment limitation and the hazard of erosion are management concerns. The sloping areas are well suited to hay and pasture, and the strongly sloping and steep areas are moderately suited or poorly suited. Water erosion is a management concern.

If this association is used as a site for buildings or septic tank absorption fields, the slope, the shrink-swell potential, and restricted permeability are management concerns.

8. Birkbeck-Rozetta-Fayette Association

Gently sloping to strongly sloping, moderately well drained and well drained, silty soils that formed in loess and the underlying glacial till or entirely in loess; on uplands

This association consists of soils on glacial till plains and moraines. Slopes range from 2 to 15 percent.

This association makes up about 9 percent of the county. It is about 40 percent Birkbeck soils, 17 percent Rozetta soils, 17 percent Fayette and similar soils, and 26 percent minor soils.

The moderately well drained Birkbeck soils are on gently sloping ridges and sloping side slopes on glacial till plains and moraines. Typically, the surface layer is brown, friable silt loam about 7 inches thick. The subsoil is about 48 inches thick. The upper part is yellowish brown, friable silty clay loam. The next part is yellowish

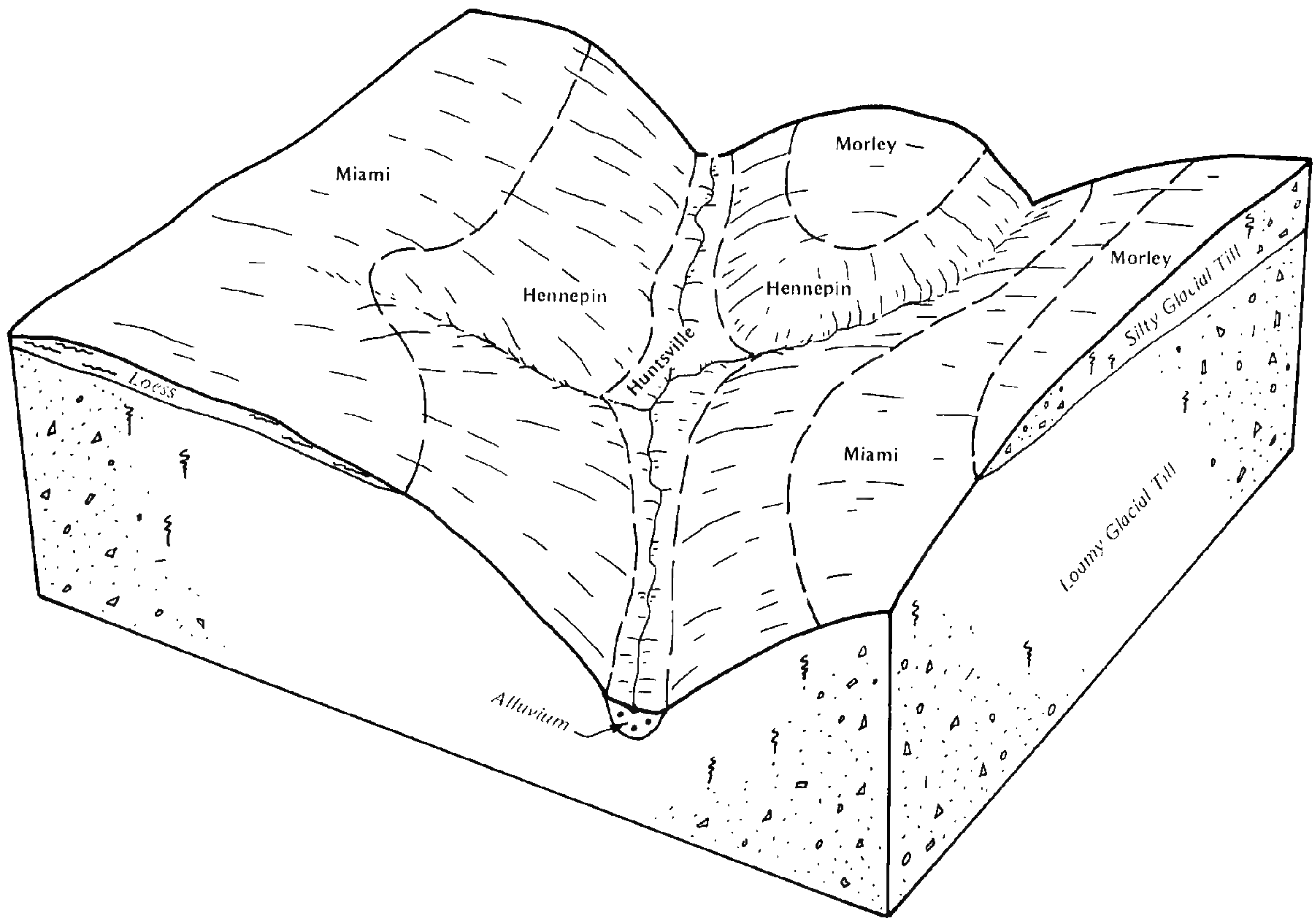


Figure 6.—Typical pattern of soils and parent material in the Hennepin-Miami-Morley association.

brown, mottled, friable silty clay loam. The lower part is brown, mottled, firm clay loam. The substratum to a depth of 60 inches or more is brown, firm, calcareous clay loam.

The moderately well drained Rozetta soils are on gently sloping ridges and side slopes on glacial till plains. Typically, the surface layer is mixed dark brown and brown, friable silt loam about 9 inches thick. The subsoil extends to a depth of more than 60 inches. It is friable. The upper part is dark yellowish brown silty clay loam. The next part is dark yellowish brown, mottled silty clay loam. The lower part is yellowish brown, mottled silt loam.

The well drained Fayette soils are on sloping and strongly sloping side slopes on glacial till plains. Typically, the surface layer is mixed dark grayish brown and yellowish brown, friable silt loam about 6 inches thick. The subsoil extends to a depth of more than 60 inches. It is yellowish brown and friable. The upper part is silty clay loam. The next part is mottled silty clay loam. The lower part is mottled silt loam.

Minor in this association are the Alvin, Blount, Hennepin, Morley, Sawmill, and Varna soils. The well drained Alvin soils are on side slopes on stream terraces and outwash plains below the major soils. They are more sandy than the major soils. The somewhat poorly drained Blount soils are on ridgetops. They are more clayey than the major soils. The well drained Hennepin soils are on very steep side slopes. They are calcareous throughout. The moderately well drained and well drained Morley soils and the moderately well drained Varna soils are in landscape positions similar to those of the major soils. They are more clayey than the major soils. The poorly drained Sawmill soils are on flood plains below the major soils.

Most areas of this association are cultivated. The

gently sloping areas are well suited to cultivated crops, and the more sloping areas are moderately suited. Water erosion is a management concern.

If this association is used as a site for buildings or septic tank absorption fields, the wetness, the shrink-swell potential, the slope, and restricted permeability are management concerns.

Detailed Soil Map Units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and Management of the Soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the substratum, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the substratum. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alvin fine sandy loam, 7 to 20 percent slopes, is a phase of the Alvin series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Hennepin-Vanmeter complex, 30 to 60 percent slopes, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Dumps, mine, is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

The detailed soil maps of Putnam County join the maps of Bureau and La Salle Counties. Some of the names of the map units in these counties do not agree with those in Putnam County because of differences in the extent of the soils or because of conceptual changes in the classification of the soils. Also, some map units in Putnam County have different slope ranges or different degrees of erosion. The differences in the map unit names do not significantly affect the use of these maps for general planning.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The "Glossary" defines many of the terms used in describing the soils.

Soil Descriptions

23B—Blount silt loam, 1 to 5 percent slopes. This gently sloping, somewhat poorly drained soil is on ridges on glacial till plains. Individual areas are irregular in shape and range from 3 to 120 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 7 inches thick. The subsurface layer is grayish brown, mottled, friable silt loam about 3 inches thick. The subsoil is about 30 inches thick. It is brown and mottled. The upper part is friable silty clay loam. The lower part is firm, calcareous clay loam. The substratum to a depth of 60 inches or more is yellowish brown, mottled, firm, calcareous clay loam. In some

areas the surface layer is thinner and contains more clay. In other areas the depth to a seasonal high water table is more than 3 feet. In places the surface layer is darker.

Included with this soil in mapping are soils in small depressions that are ponded for short periods during the growing season. These soils make up 5 to 10 percent of the unit.

Water and air move through the Blount soil at a slow rate. Surface runoff is medium. The seasonal high water table is 1 to 3 feet below the surface during spring. Available water capacity and organic matter content are moderate. The shrink-swell potential also is moderate, and the potential for frost action is high.

In most areas this soil is cultivated. It is well suited to cultivated crops and to pasture and hay. It is poorly suited to dwellings and septic tank absorption fields.

If this soil is used for cultivated crops, measures that control erosion and lower the water table are needed. A conservation tillage system that leaves crop residue on the surface after planting, ridge tillage, contour farming, and grassed waterways help to control erosion. Surface ditches can help to lower the water table if suitable outlets are available. Keeping tillage at a minimum and incorporating crop residue into the surface layer minimize crusting and help to maintain tilth and fertility.

The seasonal high water table is a limitation on sites for dwellings. The shrink-swell potential is a limitation on sites for dwellings without basements. Installing subsurface drains around foundations helps to remove excess water. Adequately reinforcing foundations helps to prevent the structural damage caused by shrinking and swelling.

The slow permeability and the seasonal high water table are limitations on sites for septic tank absorption fields. Increasing the s.ze of the absorption field helps to overcome the restricted permeability. Installing curtain drains and mounding or raising the absorption field with suitable fill material help to overcome the seasonal high water table.

The land capability classification is IIe.

25G—Hennepin loam, 30 to 60 percent slopes. This very steep, well drained soil is on side slopes on glacial till plains. Individual areas are long and narrow and range from 10 to 100 acres in size.

Typically, the surface layer is dark brown, friable, calcareous loam about 4 inches thick. The subsoil is brown, friable, calcareous clay loam about 6 inches thick. The substratum to a depth of 60 inches or more is brown, friable, calcareous loam. In some areas the subsoil has more clay. In places it is thicker and is more acid.

Included with this soil in mapping are small areas of Rodman soils. These soils have a higher content of gravel than the Hennepin soil. They make up 2 to 5 percent of the unit.

Water and air move through the Hennepin soil at a moderately slow rate. Surface runoff is very rapid. Available water capacity is moderate. Organic matter content is moderately low. The shrink-swell potential is low, and the potential for frost action is moderate.

In most areas this soil is wooded. It is poorly suited to woodland but is well suited to habitat for woodland wildlife. It is poorly suited to nature paths and trails. It generally is unsuited to dwellings and septic tank absorption fields because of the slope.

In areas where this soil is used as woodland, the slope limits the use of equipment and measures that control erosion are needed. Erosion can be controlled by building logging roads and skid trails on or nearly on the contour, skidding logs or trees uphill with a cable and winch on the steeper slopes, establishing grass firebreaks, and seeding bare areas to grass or to a grass-legume mixture after logging activities have been completed. The use of machinery is limited to periods when the soil is firm. Plant competition hinders the growth of desirable seedlings. The undesirable plants in openings where timber has been harvested can be controlled by chemical or mechanical means. Excluding livestock from the woodland helps to prevent destruction of the leaf mulch and of desirable young trees, compaction of the soil, and damage to tree roots. Measures that protect the woodland from fire are needed.

The development of woodland wildlife habitat on this soil depends on the maintenance of the naturally occurring plant species. The greatest diversity of wildlife species can be achieved by managing for a variety of tree and shrub species. Establishing wildlife food plots and additional cover is difficult because of the slope. Planting on the contour and maintaining a ground cover help to control erosion. Dead trees, fallen logs, and brush piles should be left for cover and nesting sites. Measures that protect the habitat from fire and from grazing by livestock are essential.

Areas used for paths and trails are subject to intensive foot traffic. They should be protected against erosion by mulch.

The land capability classification is VIIe.

27C2—Miami silt loam, 5 to 10 percent slopes, eroded. This sloping, well drained soil is on side slopes on glacial till plains. Individual areas are irregular in shape and range from 5 to 100 acres in size.

Typically, the surface layer is brown, friable silt loam

about 7 inches thick. It has been thinned by erosion. The subsoil is about 28 inches thick. It is friable. The upper part is yellowish brown silty clay loam. The next part is brown clay loam. The lower part is brown loam. The substratum to a depth of 60 inches or more is brown, firm, calcareous loam. In some areas, the soil is more eroded and the surface layer is predominantly clay loam subsoil material. In other areas the content of sand in the subsoil is less than 15 percent. In some places depth to the substratum is more than 50 inches. In other places the surface layer is darker.

Included with this soil in mapping are small areas of Metea and Sabina soils. The well drained Metea soils are in landscape positions similar to those of the Miami soil. The somewhat poorly drained Sabina soils are in nearly level areas above the Miami soil. Included soils make up 1 to 5 percent of the unit.

Water and air move through the Miami soil at a moderately slow rate. Surface runoff is medium. Available water capacity is high. Organic matter content is moderately low. Dense glacial till in the substratum affects the kind and distribution of roots. The shrink-swell potential and the potential for frost action are moderate.

In most areas this soil is cultivated. It is moderately suited to cultivated crops. It is well suited to pasture and hay and to woodland. It is moderately suited to dwellings. It is poorly suited to septic tank absorption fields.

In areas where this soil is used for cultivated crops, measures that control erosion are needed. Contour farming, terraces, grassed waterways, and a conservation tillage system that leaves crop residue on the surface after planting help to control erosion, minimize crusting, and maintain tilth and fertility. A crop rotation that includes forage crops also helps to control erosion.

In areas used as pasture, seeding and renovating on the contour, deferred grazing, stocking at a proper rate, applying fertilizer, and rotation grazing help to control erosion, increase forage production, and prevent surface compaction. A no-till system of seeding also helps to control erosion. Orchardgrass, bromegrass, timothy, alfalfa, and red clover are suitable forage species.

The shrink-swell potential is a limitation on sites for dwellings. Adequately reinforcing foundations helps to prevent the structural damage caused by shrinking and swelling.

The moderately slow permeability is a limitation on sites for septic tank absorption fields. Increasing the size of the absorption field helps to overcome this limitation.

The land capability classification is IIIe.

27D2—Miami loam, 10 to 18 percent slopes, eroded. This strongly sloping, well drained soil is on side slopes on glacial till plains. Individual areas are irregular in shape and range from 3 to 40 acres in size.

Typically, the surface layer is brown, friable loam about 7 inches thick. It has been thinned by erosion. The subsoil is clay loam about 31 inches thick. The upper part is dark yellowish brown and friable, and the lower part is brown and firm. The substratum to a depth of 60 inches or more is brown, firm, calcareous clay loam. In some areas the surface layer is darker. In severely eroded areas it is clay loam from the subsoil. In some places the content of sand in the subsoil is less than 15 percent. In other places the calcareous substratum is within a depth of 20 inches.

Included with this soil in mapping are small areas of the well drained Metea soils. These soils are in landscape positions similar to those of the Miami soil. Also included are the somewhat poorly drained Sabina soils in nearly level areas above the Miami soil. Included soils make up 2 to 10 percent of the unit.

Water and air move through the Miami soil at a moderately slow rate. Surface runoff is rapid. Available water capacity is high. Organic matter content is moderately low. Dense glacial till in the substratum affects the kind and distribution of roots. The shrink-swell potential and the potential for frost action are moderate.

In most areas this soil is used as woodland or for cultivated crops. It is well suited to woodland and to habitat for woodland wildlife. It is moderately suited to pasture and hay and to dwellings. It is poorly suited to cultivated crops and to septic tank absorption fields.

In areas where this soil is used for cultivated crops, measures that control erosion are needed. Contour farming, terraces, grassed waterways, and a conservation tillage system that leaves crop residue on the surface after planting help to control erosion, minimize crusting, and maintain tilth and fertility. A crop rotation dominated by forage crops helps to control erosion.

In areas used as pasture, seeding and renovating on the contour, deferred grazing, stocking at a proper rate, applying fertilizer, and rotation grazing help to control erosion, increase forage production, and prevent surface compaction. A no-till system of seeding also helps to control erosion. Orchardgrass, bromegrass, timothy, alfalfa, and red clover are suitable forage species.

In areas used as woodland, plant competition is a management concern. It hinders the growth of desirable seedlings. The undesirable plants in openings where timber has been harvested can be controlled by chemical or mechanical means. Excluding livestock

from the woodland helps to prevent destruction of the leaf mulch and of desirable young trees, compaction of the soil, and damage to tree roots. Measures that protect the woodland from fire are needed.

The development of woodland wildlife habitat on this soil depends on the maintenance of the naturally occurring plant species. The greatest diversity of wildlife species can be achieved by managing for a variety of tree and shrub species. Dead trees, fallen logs, and brush piles should be left for cover and nesting sites. Measures that protect the habitat from fire and from grazing by livestock are essential.

The shrink-swell potential, the slope, and erosion are management concerns on sites for dwellings. Adequately reinforcing foundations helps to prevent the structural damage caused by shrinking and swelling. Land shaping may be needed. Maintaining a cover of mulch until plants in newly seeded areas are established helps to control erosion.

The moderately slow permeability is a limitation on sites for septic tank absorption fields. Increasing the size of the absorption field helps to overcome this limitation.

The land capability classification is IVe.

27F—Miami loam, 18 to 30 percent slopes. This steep, well drained soil is on side slopes on glacial till plains. Individual areas are long and narrow or irregular in shape and range from 3 to 100 acres in size.

Typically, the surface layer is very dark brown, friable loam about 5 inches thick. The subsurface layer is brown, friable loam about 4 inches thick. The subsoil is friable clay loam about 22 inches thick. The upper part is brown, the next part is dark yellowish brown, and the lower part is brown. The substratum to a depth of 60 inches or more is firm, brown, calcareous loam. In some areas, the subsoil is thinner and carbonates are nearer to the surface. In other areas the subsoil contains more clay.

Included with this soil in mapping are small areas of the moderately well drained Birkbeck and well drained Huntsville soils. Birkbeck soils are on side slopes and narrow ridges above the Miami soil. Huntsville soils are on flood plains below the Miami soil. Included soils make up 5 to 10 percent of the unit.

Water and air move through the Miami soil at a moderately slow rate. Surface runoff is rapid. Available water capacity is high. Organic matter content is moderately low. Dense glacial till in the substratum affects the kind and distribution of roots. The shrink-swell potential and the potential for frost action are moderate.

In most areas this soil is wooded. It is moderately suited to woodland and is well suited to habitat for woodland wildlife. It is poorly suited to dwellings and septic tank absorption fields. It generally is unsuited to cultivated crops and to pasture and hay because of the slope.

In areas where this soil is used as woodland, the slope limits the use of equipment and measures that control erosion are needed. Erosion can be controlled by building logging roads and skid trails on or nearly on the contour, skidding logs or trees uphill with a cable and winch on the steeper slopes, establishing grass firebreaks, and seeding bare areas to grass or to a grass-legume mixture after logging activities have been completed. The use of machinery is limited to periods when the soil is firm. Plant competition hinders the growth of desirable seedlings. The undesirable plants in openings where timber has been harvested can be controlled by chemical or mechanical means. Excluding livestock from the woodland helps to prevent destruction of the leaf mulch and of desirable young trees, compaction of the soil, and damage to tree roots. Measures that protect the woodland from fire are needed.

The development of woodland wildlife habitat on this soil depends on the maintenance of the naturally occurring plant species. The greatest diversity of wildlife species can be achieved by managing for a variety of tree and shrub species. Establishing wildlife food plots and additional cover is difficult because of the slope. Planting on the contour and maintaining a ground cover help to control erosion. Dead trees, fallen logs, and brush piles should be left for cover and nesting sites. Measures that protect the habitat from fire and from grazing by livestock are essential.

The slope and erosion are management concerns in areas used as sites for dwellings. The shrink-swell potential is an additional limitation on sites for dwellings without basements. Land shaping may be needed. Maintaining a cover of mulch until plants in newly seeded areas are established helps to control erosion. Adequately reinforcing foundations helps to prevent the structural damage caused by shrinking and swelling.

The moderately slow permeability and the slope are limitations on sites for septic tank absorption fields. Increasing the size of the absorption field, land shaping, and installing distribution lines across the slope help to overcome these limitations.

The land capability classification is VIe.

36B—Tama silt loam, 2 to 5 percent slopes. This gently sloping, moderately well drained soil is on ridges and side slopes on glacial till plains. Individual areas are oblong or irregular in shape and range from 5 to 160 acres in size.

Typically, the surface layer is very dark brown, friable

silt loam about 8 inches thick. The subsurface layer is very dark grayish brown, friable silt loam about 6 inches thick. The subsoil is about 43 inches thick. It is friable. The upper part is dark yellowish brown silty clay loam. The next part is dark yellowish brown, mottled silty clay loam. The lower part is dark yellowish brown, mottled silt loam. The substratum to a depth of 60 inches or more is dark yellowish brown, mottled, friable, calcareous silt loam. In places the substratum has a higher content of sand. A few areas are moderately eroded and have a thinner surface layer. In some places carbonates are within a depth of 40 inches.

Included with this soil in mapping are small areas of the poorly drained Sable soils in nearly level areas below the Tama soil. They make up 2 to 10 percent of the unit.

Water and air move through the Tama soil at a moderate rate. Surface runoff is medium. The seasonal high water table is 4 to 6 feet below the surface during spring. Available water capacity is high. Organic matter content is moderate. The shrink-swell potential also is moderate, and the potential for frost action is high.

In most areas this soil is cultivated. It is well suited to cultivated crops and to pasture and hay. It is moderately well suited to dwellings and septic tank absorption fields.

In areas where this soil is used for cultivated crops, measures that control erosion are needed. Contour farming, grassed waterways, and a conservation tillage system that leaves crop residue on the surface after planting help to control erosion, minimize crusting, and maintain tilth and fertility.

The shrink-swell potential is a limitation on sites for dwellings. The seasonal high water table is an additional limitation on sites for dwellings with basements. Adequately reinforcing foundations helps to prevent the structural damage caused by shrinking and swelling. Installing subsurface drains around basement foundations helps to remove excess water.

The seasonal high water table is a limitation on sites for septic tank absorption fields. Installing curtain drains helps to remove excess water from around the absorption field.

The land capability classification is IIe.

36C2—Tama silt loam, 5 to 10 percent slopes, eroded. This sloping, moderately well drained soil is on ridges and side slopes on glacial till plains. Individual areas are irregular in shape and range from 3 to 200 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 9 inches thick. It has been thinned by erosion. The subsoil is about 36 inches thick. It is friable. The upper part is dark brown silty clay loam. The next part is dark yellowish brown, mottled silty clay loam. The lower part is yellowish brown, mottled silt loam. The substratum to a depth of 60 inches or more is yellowish brown, mottled, friable, calcareous silt loam. In some areas the surface layer is lighter in color. In other areas, the subsoil contains more sand and carbonates are within a depth of 40 inches.

Included with this soil in mapping are small areas of the somewhat poorly drained Muscatine and poorly drained Sawmill soils. Muscatine soils are lower on the landscape than the Tama soil. Sawmill soils are on flood plains below the Tama soil and are subject to flooding. Included soils make up 2 to 10 percent of the unit.

Water and air move through the Tama soil at a moderate rate. Surface runoff is medium. The seasonal high water table is 4 to 6 feet below the surface during spring. Available water capacity is high. Organic matter content is moderate. The shrink-swell potential also is moderate, and the potential for frost action is high.

In most areas this soil is cultivated. It is moderately suited to cultivated crops. It is well suited to pasture and hay. It is moderately suited to dwellings and to septic tank absorption fields.

In areas where this soil is used for cultivated crops, measures that control erosion are needed. Contour farming, terraces, grassed waterways, and a conservation tillage system that leaves crop residue on the surface after planting help to control erosion, minimize crusting, and maintain tilth and fertility. A crop rotation that includes forage crops also helps to control erosion.

The shrink-swell potential is a limitation on sites for dwellings. The seasonal high water table is an additional limitation on sites for dwellings with basements. Adequately reinforcing foundations helps to prevent the structural damage caused by shrinking and swelling. Installing subsurface drains around basement foundations helps to remove excess water.

The seasonal high water table is a limitation on sites for septic tank absorption fields. Installing curtain drains helps to remove excess water from around the absorption field.

The land capability classification is IIIe.

37B—Worthen silt loam, 1 to 5 percent slopes. This gently sloping, well drained soil is on alluvial fans. Individual areas are elongated or irregular in shape and range from 5 to 50 acres in size.

Typically, the surface layer is black, friable silt loam about 8 inches thick. The subsurface layer is very dark grayish brown, friable silt loam about 16 inches thick. The subsoil is about 33 inches thick. It is friable. The

upper part is dark brown silt loam. The next part is dark brown silty clay loam. The lower part is brown loam. The substratum to a depth of 60 inches or more is dark yellowish brown, friable, calcareous silt loam. In places the dark surface soil is thinner. In some areas the subsoil contains more clay. In other areas it contains more sand.

Included with this soil in mapping are small areas of the somewhat poorly drained Littleton soils. These soils are slightly lower on the landscape than the Worthen soil and are subject to flooding. They make up 2 to 5 percent of the unit.

Water and air move through the Worthen soil at a moderate rate. Surface runoff is medium. Available water capacity is very high. Organic matter content is moderate. The shrink-swell potential is low, and the potential for frost action is high.

In most areas this soil is cultivated. It is well suited to cultivated crops and to dwellings and septic tank absorption fields.

In areas where this soil is used for cultivated crops, measures that control erosion are needed. Contour farming, grassed waterways, and a conservation tillage system that leaves crop residue on the surface after planting help to control erosion, minimize crusting, and maintain tilth and fertility.

The land capability classification is IIe.

41—Muscatine silt loam. This nearly level, somewhat poorly drained soil is on broad ridges on glacial till plains. Individual areas are irregular in shape and range from 5 to 200 acres in size.

Typically, the surface layer is black, friable silt loam about 8 inches thick. The subsurface layer is very dark grayish brown, friable silt loam about 6 inches thick. The subsoil is about 38 inches thick. It is friable. The upper part is very dark grayish brown silt loam. The next part is dark grayish brown silty clay loam. The lower part is grayish brown, mottled silty clay loam. The substratum to a depth of 60 inches or more is grayish brown, mottled, friable silt loam. In some areas the substratum contains more sand. In other areas the subsoil does not have mottles. In a few places the soil is more sloping, is moderately eroded, and has a surface layer that is not so dark.

Included with this soil in mapping are small areas of the poorly drained Sable and Harpster soils. These soils are on the slightly lower broad ridges. They make up 5 to 10 percent of the unit.

Water and air move through the Muscatine soil at a moderate rate. Surface runoff is slow. The seasonal high water table is 2 to 4 feet below the surface during spring. Available water capacity is high. Organic matter content also is high. The shrink-swell potential is moderate, and the potential for frost action is high.

In most areas this soil is cultivated. It is well suited to cultivated crops and to pasture and hay. It is moderately suited to dwellings without basements. It is poorly suited to dwellings with basements and to septic tank absorption fields.

In areas where this soil is used for cultivated crops, measures that lower the seasonal high water table are needed. Surface ditches and subsurface tile drains function satisfactorily if suitable outlets are available. A conservation tillage system that leaves crop residue on the surface after planting helps to maintain tilth and fertility.

The seasonal high water table is a limitation on sites for dwellings. The shrink-swell potential is an additional limitation on sites for dwellings without basements. Installing subsurface drains around foundations helps to remove excess water. Adequately reinforcing foundations helps to prevent the structural damage caused by shrinking and swelling.

The seasonal high water table is a limitation on sites for septic tank absorption fields. Installing drains and mounding or raising the absorption field with suitable fill material help to overcome this limitation.

The land capability classification is I.

53B—Bloomfield loamy fine sand, 1 to 7 percent slopes. This gently sloping, somewhat excessively drained soil is on dunes. Individual areas are irregular in shape and range from 3 to 100 acres in size.

Typically, the surface layer is dark yellowish brown, very friable loamy fine sand about 9 inches thick. The subsurface layer is yellowish brown, loose fine sand about 12 inches thick. The subsoil extends to a depth of more than 60 inches. The upper part is yellowish brown, loose sand that has bands of strong brown, very friable loamy sand. The lower part is yellowish brown, fine sand that has bands of strong brown, very friable loamy fine sand and fine sand. In some areas the lower part of the subsoil does not have bands of loamy fine sand.

Included with this soil in mapping are small areas of the somewhat poorly drained Ridgeville soils. These soils are in nearly level areas below the Bloomfield soil. They make up 2 to 10 percent of the unit.

Water and air move through the Bloomfield soil at a rapid rate. Surface runoff is slow. Available water capacity and organic matter content are low. The shrink-swell potential and the potential for frost action also are low.

In most areas this soil is cultivated. It is moderately suited to cultivated crops. It is well suited to dwellings. It is poorly suited to septic tank absorption fields. It is a probable source of sand.

In areas where this soil is used for cultivated crops,

the low available water capacity is a limitation and measures that control soil blowing are needed. Contour farming and a conservation tillage system that leaves crop residue on the surface after planting help to control soil blowing and conserve soil moisture. Winter cover crops and field windbreaks also help to control soil blowing. Irrigation systems may be needed because of the low available water capacity.

In areas used for pasture and hay, the low available water capacity is a limitation and measures that control soil blowing are needed. Seeding, rotation grazing, deferred grazing, and applications of fertilizer help to keep the pasture in good condition and help to control soil blowing. Irrigation systems may be needed because of the low available water capacity. Orchardgrass, bromegrass, timothy, alfalfa, and red clover are suitable forage species.

This soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of ground water. Installing a sealed sand filter and a disinfection tank helps to ensure that the septic tank system functions properly.

The land capability classification is IIIs.

53D—Bloomfield loamy fine sand, 7 to 20 percent slopes. This strongly sloping, somewhat excessively drained soil is on the side slopes of dunes. Individual areas are irregular in shape and range from 5 to 80 acres in size.

Typically, the surface layer is dark brown, very friable loamy fine sand about 4 inches thick. The subsurface layer is dark yellowish brown, very friable fine sand about 18 inches thick. The subsoil extends to a depth of more than 60 inches. It is yellowish brown, loose fine sand that has bands of dark yellowish brown, very friable loamy fine sand and loamy sand. In some areas the subsoil contains more clay. In other areas the surface layer is darker.

Included with this soil in mapping are small areas of the somewhat poorly drained Ridgeville soils. These soils are in nearly level areas below the Bloomfield soil. They make up 2 to 10 percent of the unit.

Water and air move through the Bloomfield soil at a rapid rate. Surface runoff is medium. Available water capacity and organic matter content are low. The shrink-swell potential and the potential for frost action also are low.

In most areas this soil is used for woodland or pasture. It is poorly suited to cultivated crops and to septic tank absorption fields. It is moderately suited to woodland, to pasture and hay, and to dwellings.

If this soil is cultivated, the low available water capacity is a limitation and measures that control soil blowing and water erosion are needed. Contour farming, grassed waterways, and a conservation tillage system that leaves crop residue on the surface after planting help to control soil blowing and water erosion and conserve soil moisture. Winter cover crops and field windbreaks also help to control soil blowing. A crop rotation that includes 1 or more years of forage crops helps to control erosion. Irrigation systems may be needed because of the low available water capacity.

In areas where this soil is used for pasture and hay, the low available water capacity is a limitation and measures that control soil blowing and water erosion are needed. Seeding, rotation grazing, deferred grazing, and applications of fertilizer help to keep the pasture in good condition and help to control soil blowing and water erosion. Irrigation systems may be needed because of the low available water capacity. Orchardgrass, bromegrass, timothy, alfalfa, and red clover are suitable forage species.

In areas used as woodland, seedling mortality is a management concern because of the low available water capacity. The seedling mortality rate can be reduced by managing for or planting species that are tolerant of droughty conditions, by removing all competing vegetation within 2 feet of the existing or planted seedlings, and by selecting the larger seedlings for planting. Excluding livestock from the woodland helps to prevent destruction of the leaf mulch and of desirable young trees, compaction of the soil, and damage to tree roots. Measures that protect the woodland from fire are needed.

The slope and erosion are management concerns in areas used as sites for dwellings. Land shaping may be needed. Keeping the disturbance of natural vegetation to a minimum and maintaining a cover of mulch until plants are established in newly seeded disturbed areas help to control erosion. Because of the low available water capacity, periodic watering is needed to establish and maintain lawns.

This soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of ground water. Installing a sealed sand filter and a disinfection tank helps to ensure that the septic tank system functions properly.

The land capability classification is IVe.

67—Harpster silty clay loam. This nearly level, poorly drained soil is on broad ridges on glacial till plains. It is occasionally ponded for brief periods in winter and spring. Individual areas are irregular in shape and range from 5 to 80 acres in size.

Typically, the surface layer is black, friable, calcareous silty clay loam about 10 inches thick. The

subsurface layer also is black, friable, calcareous silty clay loam. It is about 5 inches thick. The subsoil is about 31 inches thick. It is friable and calcareous. The upper part is olive gray silty clay loam. The next part is olive gray, mottled silty clay. The lower part is light olive gray, mottled silt loam. The substratum to a depth of 60 inches or more is light olive gray, mottled, friable, calcareous silt loam. In some areas the depth to carbonates is more than 16 inches.

Included with this soil in mapping are small areas of the somewhat poorly drained Muscatine and moderately well drained Tama soils. These soils are slightly higher on the landscape than the Harpster soil. They make up 2 to 10 percent of the unit.

Water and air move through the Harpster soil at a moderate rate. Surface runoff is slow to ponded. The seasonal high water table is 0.5 foot above the surface to 2.0 feet below during winter and spring. Available water capacity is high. Organic matter content also is high. The shrink-swell potential is moderate, and the potential for frost action is high.

In most areas this soil is cultivated. It is well suited to cultivated crops and to pasture and hay. It generally is unsuited to dwellings and septic tank absorption fields because of the ponding.

In areas where this soil is used for cultivated crops, a high content of lime is a limitation and measures that lower the seasonal high water table are needed. The high content of lime decreases the availability of phosphorus and potassium. Applying phosphorus and potassium helps to overcome this limitation. Keeping tillage at a minimum and incorporating crop residue into the surface layer minimize crusting and help to maintain tilth and fertility. Maintaining or improving the drainage system helps to lower the water table. Subsurface drains function satisfactorily if suitable outlets are available. Surface ditches help to remove excess water.

The land capability classification is IIw.

68—Sable silty clay loam. This nearly level, poorly drained soil is in broad ridges on glacial till plains. It is occasionally ponded for brief periods in winter and spring. Individual areas are irregular in shape and range from 5 to more than 500 acres in size.

Typically, the surface layer is black, friable silty clay loam about 9 inches thick. The subsurface layer is black, friable silty clay loam about 5 inches thick. The subsoil is about 33 inches thick. It is mottled and friable. The upper part is very dark gray silty clay loam. The next part is olive gray silty clay loam. The lower part is light olive gray silt loam. The substratum to a depth of 60 inches or more is light olive gray, mottled, friable, calcareous silt loam. In some areas depth to the seasonal high water table is more than 2 feet. In other areas the substratum contains more sand.

Included with this soil in mapping are small areas of the poorly drained Harpster and moderately well drained Tama soils. Harpster soils are calcareous. They are in landscape positions similar to those of the Sable soil. Tama soils are on ridges above the Sable soil. Included soils make up 2 to 10 percent of the unit.

Water and air move through the Sable soil at a moderate rate. Surface runoff is slow to ponded. The seasonal high water table is 0.5 foot above the surface to 2.0 feet below during spring. Available water capacity is very high. Organic matter content is high. The shrink-swell potential is moderate, and the potential for frost action is high.

In most areas this soil is cultivated. It is well suited to cultivated crops and to pasture and hay. It is generally unsuited to dwellings and septic tank absorption fields because of the ponding.

In areas where this soil is used for cultivated crops, measures that lower the seasonal high water table are needed. Maintaining or improving the drainage system helps to maintain productivity. Subsurface drains function satisfactorily if suitable outlets are available. Surface ditches help to remove excess water. Keeping tillage at a minimum and incorporating crop residue into the surface layer minimize crusting and help to maintain tilth and fertility.

The land capability classification is IIw.

93B—Rodman gravelly loam, 2 to 7 percent slopes. This gently sloping, excessively drained soil is on stream terraces. Individual areas are oblong or irregular in shape and range from 5 to 20 acres in size.

Typically, the surface layer is very dark grayish brown, friable gravelly loam about 8 inches thick. The subsoil is dark yellowish brown, friable gravelly loam about 3 inches thick. The substratum to a depth of 60 inches or more is yellowish brown, loose, calcareous extremely gravelly coarse sand. In some areas the slope is more than 7 percent. In other areas the extremely gravelly substratum is below a depth of 20 inches.

Included with this soil in mapping are small areas of the well drained Terril and Martinsville soils. These soils have less gravel and more clay in the subsoil than the Rodman soil. They are in landscape positions similar to those of the Rodman soil. They make up 5 to 10 percent of the unit.

Water and air move through the Rodman soil at a very rapid rate. Surface runoff is slow. Available water capacity is very low. Organic matter content is moderate. The shrink-swell potential and the potential for frost action are low.

In most areas this soil is used for pasture and hay. It

is moderately suited to pasture and hay. It is poorly suited to cultivated crops and to septic tank absorption fields. It is well suited to dwellings.

If this soil is used for cultivated crops, the very low available water capacity is a limitation and measures that control soil blowing are needed. A conservation tillage system that leaves crop residue on the surface after planting helps to control soil blowing and conserves soil moisture. Winter cover crops and field windbreaks also help to control soil blowing. Irrigation systems may be needed because of the very low available water capacity.

In areas where this soil is used for pasture and hay, the very low available water capacity is a limitation and measures that control soil blowing are needed. Seeding, rotation grazing, deferred grazing, and applications of fertilizer help to keep the pasture in good condition and help to control soil blowing. Irrigation systems may be needed because of the very low available water capacity. Orchardgrass, bromegrass, timothy, alfalfa, and red clover are suitable forage species.

This soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of ground water. Installing a sealed sand filter and a disinfection tank helps to ensure that the septic tank system functions properly.

The land capability classification is IVs.

93E—Rodman gravelly sandy loam, 12 to 30 percent slopes. This steep, excessively drained soil is on stream terrace escarpments. Individual areas are elongated and range from 5 to 80 acres in size.

Typically, the surface layer is black, friable gravelly sandy loam about 5 inches thick. The subsurface layer is very dark grayish brown, friable, calcareous gravelly sandy loam about 4 inches thick. The subsoil is dark brown, very friable, calcareous gravelly sandy loam about 5 inches thick. The substratum to a depth of 60 inches or more is yellowish brown, loose, calcareous very gravelly very coarse sand. In some areas the slope is less than 12 percent. In other areas the surface layer is lighter in color. In places the soil contains less gravel throughout. In a few areas it has a thicker dark surface layer.

Included with this soil in mapping are small areas of the well drained Wea soils. These soils have more clay and less gravel throughout than the Rodman soil. They are in the less sloping areas above the Rodman soil. They make up 5 to 10 percent of the unit.

Water and air move through the Rodman soil at a very rapid rate. Surface runoff is medium. Available water capacity is very low. Organic matter content is moderate. The shrink-swell potential and the potential for frost action are low.

In most areas this soil is used as woodland or pasture. It is poorly suited to woodland. It generally is unsuited to cultivated crops and hay because of the slope and the very low available water capacity. It is poorly suited to pasture, to habitat for woodland wildlife, and to dwellings and septic tank absorption fields.

In areas where this soil is used as woodland, the slope limits the use of equipment and measures that control erosion are needed. Erosion can be controlled by building logging roads and skid trails on or nearly on the contour, skidding logs or trees uphill with a cable and winch on the steeper slopes, establishing grass firebreaks, and seeding bare areas to grass or to a grass-legume mixture after logging activities have been completed. The use of machinery is limited to periods when the soil is firm. Seedling mortality is high because of the very low available water capacity. Planting mature nursery stock and clearing all competing vegetation within 2 feet of the planted seedlings reduce the seedling mortality rate. Excluding livestock from the woodland helps to prevent destruction of the leaf mulch and of desirable young trees, compaction of the soil, and damage to tree roots. Measures that protect the woodland from fire are needed.

In areas used as pasture, the very low available water capacity is a limitation and measures that control soil blowing and water erosion are needed. Seeding, rotation grazing, deferred grazing, and applications of fertilizer help to keep the pasture in good condition and help to control soil blowing and water erosion. A no-till method of pasture renovation and seeding on the contour help to control water erosion. Irrigation systems may be needed because of the very low available water capacity. Orchardgrass, bromegrass, timothy, alfalfa, and red clover are suitable forage species.

The development of woodland wildlife habitat on this soil depends on the maintenance of the naturally occurring plant species. The greatest diversity of wildlife species can be achieved by managing for a variety of tree and shrub species. Establishing wildlife food plots and additional cover is difficult because of the slope. Planting on the contour and maintaining a ground cover help to control erosion. Dead trees, fallen logs, and brush piles should be left for cover and nesting sites. Measures that protect the habitat from fire and from grazing by livestock are essential.

If this soil is used as a site for dwellings, the slope is a limitation and measures that control erosion are needed. Land shaping may be needed. Keeping the disturbance of natural vegetation to a minimum and maintaining a cover of mulch until plants are established in newly seeded disturbed areas help to

control erosion. Because of the very low available water capacity, periodic watering is needed to establish and maintain lawns.

The slope and a poor filtering capacity are limitations on sites for septic tank absorption fields. The soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water. Installing a sealed sand filter and a disinfection tank and leveling the site help to ensure that the septic tank system functions properly.

The land capability classification is VIIs.

93G—Rodman gravelly sandy loam, 30 to 60 percent slopes. This very steep, excessively drained soil is on stream terrace escarpments. Individual areas are elongated and range from 5 to 80 acres in size.

Typically, the surface layer is black, friable, calcareous gravelly sandy loam about 6 inches thick. The subsoil is brown, very friable, calcareous gravelly sandy loam about 8 inches thick. The substratum to a depth of 60 inches or more is yellowish brown, loose, calcareous extremely gravelly very coarse sand. In some areas the subsoil is thicker. In other areas the soil has a lower content of gravel throughout. In places the slope is less than 30 percent.

Water and air move through this soil at a very rapid rate. Surface runoff is medium. Available water capacity is very low. Organic matter content is moderate. The shrink-swell potential and the potential for frost action are low.

In most areas this soil is wooded. It is poorly suited to woodland and to habitat for woodland wildlife. It generally is unsuited to cultivated crops, to pasture and hay, to dwellings, and to septic tank absorption fields because of the slope.

In areas where this soil is used as woodland, the slope limits the use of equipment and measures that control erosion are needed. Erosion can be controlled by building logging roads and skid trails on or nearly on the contour, skidding logs or trees uphill with a cable and winch on the steeper slopes, establishing grass firebreaks, and seeding bare areas to grass or to a grass-legume mixture after logging activities have been completed. The use of machinery is limited to periods when the soil is firm. Seedling mortality is high because of the very low available water capacity. Planting mature nursery stock and clearing all competing vegetation within 2 feet of the planted seedlings reduce the seedling mortality rate. Excluding livestock from the woodland helps to prevent destruction of the leaf mulch and of desirable young trees, compaction of the soil, and damage to tree roots. Measures that protect the woodland from fire are needed.

The development of woodland wildlife habitat on this soil depends on the maintenance of the naturally occurring plant species. The greatest diversity of wildlife species can be achieved by managing for a variety of tree and shrub species. Establishing wildlife food plots and additional cover is difficult because of the slope. Planting on the contour and maintaining a ground cover help to control erosion. Dead trees, fallen logs, and brush piles should be left for cover and nesting sites. Measures that protect the habitat from fire and from grazing by livestock are essential.

The land capability classification is VIIs.

98B—Ade loamy fine sand, 1 to 7 percent slopes. This gently sloping, somewhat excessively drained soil is on dunes. Individual areas are elongated or irregular in shape and range from 7 to 35 acres in size.

Typically, the surface layer is very dark grayish brown, very friable loamy fine sand about 9 inches thick. The subsurface layer is dark brown, very friable loamy fine sand about 8 inches thick. The subsoil extends to a depth of more than 60 inches. It is very friable. The upper part is brown loamy fine sand. The next part is yellowish brown fine sand. The lower part is brown fine sand that has bands of dark yellowish brown sandy loam. In some areas the surface layer is lighter in color. In other areas the surface layer and the subsoil contain more clay.

Included with this soil in mapping are small areas of the well drained Wea and Dakota soils. These soils have more clay and less sand in the surface soil and subsoil than the Ade soil. They are slightly lower on the landscape than the Ade soil. They make up 5 to 10 percent of the unit.

Water and air move through the Ade soil at a rapid rate. Surface runoff is slow. Available water capacity is low. Organic matter content is moderate. The shrink-swell potential and the potential for frost action are low.

In most areas this soil is cultivated. In some areas it is used for pasture and hay. It is moderately suited to cultivated crops. It is well suited to pasture and hay and to dwellings. It is poorly suited to septic tank absorption fields. It is a probable source of sand.

In areas where this soil is used for cultivated crops, the low available water capacity is a limitation and measures that control soil blowing are needed. A conservation tillage system that leaves crop residue on the surface after planting helps to control soil blowing and conserves soil moisture. Winter cover crops and field windbreaks also help to control soil blowing. Irrigation systems may be needed because of the low available water capacity.

In areas used for pasture and hay, the low available water capacity is a limitation and measures that control soil blowing are needed. Seeding, rotation grazing,

deferred grazing, and applications of fertilizer help to keep the pasture in good condition and help to control soil blowing. Irrigation systems may be needed because of the low available water capacity. Orchardgrass, bromegrass, timothy, alfalfa, and red clover are suitable forage species.

This soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of ground water. Installing a sealed sand filter and a disinfection tank helps to ensure that the septic tank system functions properly.

The land capability classification is IIIs.

98D—Ade loamy fine sand, 7 to 15 percent slopes. This strongly sloping, somewhat excessively drained soil is on the side slopes of dunes. Individual areas are long and narrow, crescent shaped, or irregular in shape and range from 5 to 45 acres in size.

Typically, the surface layer is very dark grayish brown, very friable sand about 10 inches thick. The subsurface layer is dark brown, very friable fine sand about 7 inches thick. The subsoil extends to a depth of more than 60 inches. The upper part is brown, very friable fine sand. The lower part is yellowish brown, loose fine sand that has bands of dark brown sandy loam and loamy sand. In some areas the surface layer is lighter in color. In other areas the surface layer and the subsoil contain more clay.

Included with this soil in mapping are small areas of the poorly drained Orio and somewhat poorly drained Ridgeville soils. Orio soils are in depressions. Ridgeville soils are in nearly level areas below the Ade soil. Included soils make up 2 to 10 percent of the unit.

Water and air move through the Ade soil at a rapid rate. Surface runoff is medium. Available water capacity is low. Organic matter content is moderate. The shrink-swell potential and the potential for frost action are low.

In most areas this soil is cultivated. It is moderately suited to cultivated crops and to pasture and hay. It is poorly suited to septic tank absorption fields and moderately suited to dwellings. It is a probable source of sand.

In areas where this soil is used for cultivated crops, the low available water capacity is a limitation and measures that control soil blowing and water erosion are needed. Contour farming, grassed waterways, and a conservation tillage system that leaves crop residue on the surface after planting help to control soil blowing and water erosion and conserve soil moisture. Winter cover crops and field windbreaks also help to control soil blowing. A crop rotation that includes forage crops helps to control erosion. Irrigation systems may be needed because of the low available water capacity.

In areas used for pasture and hay, the low available water capacity is a limitation and measures that control soil blowing and water erosion are needed. Seeding, rotation grazing, deferred grazing, and applications of fertilizer help to keep the pasture in good condition and help to control soil blowing and water erosion. Irrigation systems may be needed because of the low available water capacity. Orchardgrass, bromegrass, timothy, alfalfa, and red clover are suitable forage species.

The slope and erosion are management concerns in areas used as sites for dwellings. Land shaping may be needed. Keeping the amount of vegetation to a minimum and maintaining a cover of mulch until plants are established in newly seeded disturbed areas help to control erosion. Because of the low available water capacity, periodic watering is needed to establish and maintain lawns.

This soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of ground water. Installing a sealed sand filter and a disinfection tank helps to ensure that the septic tank system functions properly.

The land capability classification is IIIe.

131B2—Alvin fine sandy loam, 2 to 7 percent slopes, eroded. This gently sloping, well drained soil is on stream terraces and outwash plains. Individual areas are irregular in shape and range from 7 to 40 acres in size.

Typically, the surface layer is mixed dark brown and dark yellowish brown, friable fine sandy loam about 8 inches thick. It has been thinned by erosion. The subsoil extends to a depth of more than 60 inches. It is friable. The upper part is dark yellowish brown sandy clay loam. The next part is dark yellowish brown sandy loam. The lower part is light yellowish brown loamy sand that has bands of dark yellowish brown sandy loam. In some areas the surface layer is darker or thicker. In other areas the subsoil contains more sand and less clay. In places the lower part of the subsoil is silty clay loam that has some pebbles.

Included with this soil in mapping are small areas of the somewhat poorly drained Ridgeville soils. These soils have a darker surface layer than the Alvin soil. They are in nearly level areas below the Alvin soil. They make up 2 to 7 percent of the unit.

Water and air move through the Alvin soil at a moderate rate. Surface runoff is slow. Available water capacity is moderate. Organic matter content is low. The shrink-swell potential is low, and the potential for frost action is moderate.

In most areas this soil is cultivated. In some areas it is used for pasture and hay. It is well suited to

cultivated crops, to pasture and hay, to septic tank absorption fields, and to dwellings.

In areas where this soil is used for cultivated crops, the moderate available water capacity is a limitation and measures that control soil blowing and water erosion are needed. Contour farming, grassed waterways, and a conservation tillage system that leaves crop residue on the surface after planting help to control soil blowing and water erosion and conserve soil moisture. Winter cover crops and field windbreaks also help to control soil blowing. Irrigation systems may be needed because of the moderate available water capacity.

In areas used for pasture and hay, the moderate available water capacity is a limitation and measures that control soil blowing and water erosion are needed. Seeding, rotation grazing, deferred grazing, and applications of fertilizer help to keep the pasture in good condition and help to control soil blowing and water erosion. Irrigation systems may be needed because of the moderate available water capacity. Orchardgrass, bromegrass, timothy, alfalfa, and red clover are suitable forage species.

The land capability classification is IIe.

131D—Alvin fine sandy loam, 7 to 20 percent slopes. This strongly sloping, well drained soil is on the side slopes of stream terraces and outwash plains. Individual areas are long and narrow and range from 3 to 50 acres in size.

Typically, the surface layer is very dark grayish brown, friable fine sandy loam about 4 inches thick. The subsurface layer is brown, friable fine sandy loam about 4 inches thick. The subsoil is about 36 inches thick. The upper part is dark yellowish brown, friable fine sandy loam. The next part is strong brown, friable sandy loam. The lower part is strong brown, loose loamy sand that has bands of sandy loam. The substratum to a depth of 60 inches or more is strong brown, loose loamy sand. In some areas the subsoil is thinner and contains less clay. In other areas the substratum is glacial till. In places the surface layer and the subsoil contain more sand and less clay.

Included with this soil in mapping are small areas of the poorly drained Orio soils. These soils have a darker surface layer than the Alvin soil. They are in nearly level depressions below the Alvin soil. They make up 2 to 5 percent of the unit.

Water and air move through the Alvin soil at a moderate rate. Surface runoff is medium. Available water capacity is moderate. Organic matter content is low. The shrink-swell potential is low, and the potential for frost action is moderate.

In most areas this soil is used as pasture. In some areas it is used as woodland. It is moderately suited to cultivated crops, to pasture and hay, to dwellings, and to septic tank absorption fields.

If this soil is used for cultivated crops, the moderate available water capacity is a limitation and measures that control soil blowing and water erosion are needed. Contour farming, grassed waterways, and a conservation tillage system that leaves crop residue on the surface after planting help to control soil blowing and water erosion and conserve soil moisture. Winter cover crops and field windbreaks also help to control soil blowing. A crop rotation that includes forage crops helps to control erosion. Irrigation systems may be needed because of the moderate available water capacity.

In areas where this soil is used for pasture and hay, the moderate available water capacity is a limitation and measures that control soil blowing and water erosion are needed. Seeding, rotation grazing, deferred grazing, and applications of fertilizer help to keep the pasture in good condition and help to control soil blowing and water erosion. Irrigation systems may be needed because of the moderate available water capacity. Orchardgrass, bromegrass, timothy, alfalfa, and red clover are suitable forage species.

In areas used as woodland, plant competition is a management concern. It hinders the growth of desirable seedlings. The undesirable plants in openings where timber has been harvested can be controlled by chemical or mechanical means. Excluding livestock from the woodland helps to prevent destruction of the leaf mulch and of desirable young trees, compaction of the soil, and damage to tree roots. Measures that protect the woodland from fire are needed.

The slope and erosion are management concerns in areas used as sites for dwellings. Land shaping may be needed. Maintaining a cover of mulch until plants in newly seeded areas are established helps to control erosion.

The slope and a poor filtering capacity are limitations on sites for septic tank absorption fields. Land shaping and installing the distribution lines on the contour help to overcome the slope. The soil readily absorbs but does not adequately filter the effluent. The poor filtering capacity can result in the pollution of ground water. Installing a sealed sand filter and a disinfection tank helps to ensure that the septic tank system functions properly.

The land capability classification is IIIe.

131F—Alvin fine sandy loam, 20 to 30 percent slopes. This steep, well drained soil is on the side slopes of stream terraces and outwash plains. Individual areas are irregular in shape and range from 10 to 30 acres in size.

Typically, the surface layer is dark grayish brown, very friable fine sandy loam about 6 inches thick. The subsurface layer is brown, very friable loamy fine sand about 12 inches thick. The subsoil extends to a depth of more than 60 inches. It is friable. The upper part is dark yellowish brown fine sandy loam. The next part is brown sandy loam. The lower part is dark yellowish brown sandy loam. In some areas the slope is more than 30 percent. In other areas the subsoil contains less clay.

Included with this soil in mapping are small areas of the well drained Hennepin and Miami soils. These soils have more clay throughout than the Alvin soil. They are in landscape positions similar to those of the Alvin soil. They make up about 7 to 15 percent of the unit.

Water and air move through the Alvin soil at a moderate rate. Surface runoff is medium. Available water capacity is moderate. Organic matter content is low. The shrink-swell potential is low, and the potential for frost action is moderate.

In most areas this soil is wooded. In some areas it is used for pasture and hay. It is moderately suited to woodland. It is well suited to habitat for woodland wildlife. It is poorly suited to pasture and hay, to dwellings, and to septic tank absorption fields. It is generally unsuited to cultivated crops because of the slope.

In areas where this soil is used for pasture and hay, the moderate available water capacity is a limitation and measures that control soil blowing and water erosion are needed. Seeding, rotation grazing, deferred grazing, and applications of fertilizer help to keep the pasture in good condition and help to control soil blowing and water erosion. A no-till method of pasture renovation and seeding on the contour help to control erosion. Irrigation systems may be needed because of the moderate available water capacity. Orchardgrass, bromegrass, timothy, alfalfa, and red clover are suitable forage species.

In areas used as woodland, the slope limits the use of equipment and measures that control erosion are needed. Erosion can be controlled by building logging roads and skid trails on or nearly on the contour, skidding logs or trees uphill with a cable and winch on the steeper slopes, establishing grass firebreaks, and seeding bare areas to grass or to a grass-legume mixture after logging activities have been completed. The use of machinery is limited to periods when the soil is firm. Plant competition hinders the growth of desirable seedlings. The undesirable plants in openings where timber has been harvested can be controlled by chemical or mechanical means. Excluding livestock from the woodland helps to prevent destruction of the leaf mulch and of desirable young trees, compaction of the soil, and damage to tree roots. Measures that protect the woodland from fire are needed.

The development of woodland wildlife habitat on this soil depends on the maintenance of the naturally occurring plant species. Establishing wildlife food plots and additional cover is difficult because of the moderate available water capacity and low fertility. Drought-resistant plant species can be used for wildlife cover. Measures that protect the habitat from fire and from grazing by livestock are essential.

The slope and erosion are management concerns in areas used as sites for dwellings. Land shaping may be needed. Maintaining a cover of mulch until plants in newly seeded areas are established helps to control erosion.

The slope is a limitation on sites for septic tank absorption fields. Land shaping and installing the distribution lines across the slope help to overcome this limitation.

The land capability classification is VIe.

134B—Camden silt loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on outwash plains and stream terraces. Individual areas are oblong or irregular in shape and range from 3 to 40 acres in size.

Typically, the surface layer is brown, friable silt loam about 8 inches thick. The subsurface layer is brown, friable silt loam about 4 inches thick. The subsoil extends to a depth of more than 60 inches. It is friable. The upper part is dark yellowish brown silty clay loam. The next part is dark yellowish brown, mottled silty clay loam. The lower part is yellowish brown, mottled loam. In some areas the lower part of the subsoil contains less sand. In other areas the upper part contains less silt and more sand. A few areas are more sloping and are eroded. In places a seasonal high water table is within a depth of 6 feet.

Included with this soil in mapping are small areas of Miami soils. These soils are in the more sloping areas below the Camden soil. They make up 2 to 10 percent of the unit.

Water and air move through the Camden soil at a moderate rate. Surface runoff is medium. Available water capacity is high. Organic matter content is moderately low. The shrink-swell potential is moderate, and the potential for frost action is high.

In most areas this soil is cultivated. It is well suited to cultivated crops, to pasture and hay, to dwellings with basements, and to septic tank absorption fields. It is moderately well suited to dwellings without basements.

In areas where this soil is used for cultivated crops, measures that control erosion are needed. Contour farming, grassed waterways, and a conservation tillage system that leaves crop residue on the surface after

planting help to control erosion, minimize crusting, and maintain tilth and fertility.

The shrink-swell potential is a limitation on sites for dwellings without basements. Adequately reinforcing foundations helps to prevent the structural damage caused by shrinking and swelling.

The land capability classification is IIe.

134C—Camden silt loam, 5 to 10 percent slopes. This sloping, well drained soil is on the side slopes of stream terraces and outwash plains. Individual areas are irregular in shape and range from 3 to 20 acres in size.

Typically, the surface layer is dark brown, friable silt loam about 7 inches thick. The subsurface layer is yellowish brown, friable silt loam about 3 inches thick. The subsoil is about 49 inches thick. It is friable. The upper part is yellowish brown silt loam. The next part is yellowish brown, mottled silty clay loam. The lower part is dark yellowish brown, mottled clay loam. The substratum to a depth of 60 inches or more is dark yellowish brown, mottled, friable clay loam. In some areas the surface layer contains more clay. In other areas it is darker. In places the lower part of the subsoil contains less sand.

Included with this soil in mapping are small areas of Miami soils. These soils are on steep side slopes below the Camden soil. They make up 2 to 10 percent of the unit.

Water and air move through the Camden soil at a moderate rate. Surface runoff is medium. Available water capacity is high. Organic matter content is moderately low. The shrink-swell potential is moderate, and the potential for frost action is high.

In most areas this soil is cultivated. It is moderately suited to cultivated crops and to dwellings without basements. It is well suited to pasture and hay, to septic tank absorption fields, and to dwellings with basements.

In areas where this soil is used for cultivated crops, measures that control erosion are needed. Contour farming, terraces, grassed waterways, and a conservation tillage system that leaves crop residue on the surface after planting help to control erosion, minimize crusting, and maintain tilth and fertility. A crop rotation that includes 1 or more years of forage crops helps to control erosion.

In areas used as pasture, seeding and renovating on the contour, deferred grazing, stocking at a proper rate, applying fertilizer, and rotation grazing help to control erosion, increase forage production, and prevent surface compaction. A no-till system of seeding also helps to control erosion. Orchardgrass, bromegrass, timothy, alfalfa, and red clover are suitable forage species.

The shrink-swell potential is a limitation on sites for dwellings without basements. Adequately reinforcing foundations helps to prevent the structural damage caused by shrinking and swelling.

The land capability classification is IIIe.

145C2—Saybrook silt loam, 5 to 10 percent slopes, eroded. This sloping, moderately well drained soil is on side slopes on glacial till plains and moraines. Individual areas are irregular in shape and range from 5 to 50 acres in size.

Typically, the surface layer is mixed very dark grayish brown and very dark gray, friable silt loam about 8 inches thick. It has been thinned by erosion. The subsoil is about 26 inches thick. The upper part is brown, friable silty clay loam. The next part is dark yellowish brown, mottled, friable silty clay loam. The lower part is light olive brown, mottled, firm, calcareous clay loam. The substratum to a depth of 60 inches or more is light olive brown, mottled, firm, calcareous clay loam. In some areas the subsoil contains less sand. In other areas the soil is calcareous within a depth of 20 inches. In some places the surface soil is thicker. In other places the subsoil contains more sand.

Included with this soil in mapping are small areas of the somewhat excessively drained Ade and poorly drained Drummer soils. Ade soils contain more sand throughout than the Saybrook soil. They are on dunes above the Saybrook soil. Drummer soils are in nearly level areas below the Saybrook soil. Included soils make up 2 to 5 percent of the unit.

Water and air move through the Saybrook soil at a moderate rate. Surface runoff is medium. The seasonal high water table is 4 to 6 feet below the surface during spring. Available water capacity is high. Organic matter content is moderate. Dense glacial till in the lower part of the subsoil and in the substratum affects the kind and distribution of roots. The shrink-swell potential is moderate, and the potential for frost action is high.

In most areas this soil is cultivated. It is moderately suited to cultivated crops, to dwellings with basements, and to septic tank absorption fields. It is well suited to pasture and hay and to dwellings without basements.

In areas where this soil is used for cultivated crops, measures that control erosion are needed. Contour farming, terraces, grassed waterways, and a conservation tillage system that leaves crop residue on the surface after planting help to control erosion, minimize crusting, and maintain tilth and fertility. A crop rotation that includes forage crops also helps to control erosion.

In areas used as pasture, seeding and renovating on the contour, deferred grazing, stocking at a proper rate, applying fertilizer, and rotation grazing help to control erosion, increase forage production, and prevent surface compaction. A no-till system of seeding also helps to control erosion. Orchardgrass, bromegrass, timothy, alfalfa, and red clover are suitable forage species.

The seasonal high water table is a limitation on sites for dwellings with basements. Installing subsurface drains around basement foundations helps to remove excess water.

The moderate permeability and the seasonal high water table are limitations on sites for septic tank absorption fields. Increasing the size of the absorption field helps to overcome the restricted permeability. Installing curtain drains helps to remove excess water from around the absorption field.

The land capability classification is IIIe.

151—Ridgeville fine sandy loam. This nearly level, somewhat poorly drained soil is on stream terraces and outwash plains. Individual areas are irregular in shape and range from 5 to 90 acres in size.

Typically, the surface soil is very dark grayish brown, very friable fine sandy loam about 11 inches thick. The subsoil is about 36 inches thick. The upper part is brown, mottled, friable fine sandy loam. The next part is mottled light brownish gray and yellowish brown, very friable fine sand. The lower part is mottled grayish brown and strong brown, very friable loamy fine sand. The substratum to a depth of 60 inches or more is mottled grayish brown and strong brown, loose fine sand. In some areas the surface layer is lighter in color. In other areas the upper part of the subsoil contains more clay. In places the substratum is silt loam below a depth of 50 inches.

Included with this soil in mapping are small areas of the somewhat excessively drained Ade and poorly drained Orio soils. Ade soils have less clay in the surface layer and in the upper part of the subsoil than the Ridgeville soil. Also, they are higher on the landscape. Orio soils are in depressions below the Ridgeville soil. They are subject to ponding. Included soils make up 10 to 15 percent of the unit.

Water and air move through the Ridgeville soil at a moderately rapid rate. Surface runoff is slow. The seasonal high water table is 1 to 3 feet below the surface during spring. Available water capacity is moderate. Organic matter content also is moderate. The shrink-swell potential is low, and the potential for frost action is high.

In most areas this soil is cultivated. It is well suited to cultivated crops and to pasture and hay. It is poorly suited to dwellings and septic tank absorption fields.

In areas where this soil is used for cultivated crops, the moderate available water capacity is a limitation and measures that control soil blowing and lower the seasonal high water table are needed. A conservation tillage system that leaves crop residue on the surface after planting helps to control soil blowing and conserves soil moisture. Winter cover crops and field windbreaks also help to control soil blowing. Subsurface drains and surface ditches help to lower the seasonal high water table if suitable outlets are available. Enclosing the subsurface drains with filter material helps to prevent the accumulation of sand in the tile. Irrigation systems may be needed because of the moderate available water capacity.

The seasonal high water table is a limitation on sites for dwellings. Subsurface drains around foundations help to remove excess water. Enclosing the drains with filter material helps to prevent the accumulation of sand in the tile.

The seasonal high water table is a limitation on sites for septic tank absorption fields. Installing drains and mounding or raising the absorption field with suitable fill material help to overcome this limitation.

The land capability classification is IIs.

154—Flanagan silt loam. This nearly level, somewhat poorly drained soil is on broad ridges on glacial till plains. Individual areas are irregular in shape and range from 5 to more than 200 acres in size.

Typically, the surface soil is black, friable silt loam about 17 inches thick. The subsoil extends to a depth of more than 60 inches. It is mottled. The upper part is dark grayish brown, friable silty clay loam. The next part is dark yellowish brown, friable silty clay loam. The lower part is light olive brown, firm, calcareous loam. In some areas, the subsoil is thicker and the depth to calcareous loam is more than 60 inches. In other areas a clay loam subsoil is within a depth of 40 inches. In some places the lower part of the subsoil contains more sand. In other places the slope is more than 2 percent.

Included with this soil in mapping are small areas of the poorly drained Drummer and Sable soils. These soils are in the slightly lower positions below the Flanagan soil. They make up 2 to 15 percent of the unit.

Water and air move through the Flanagan soil at a moderately slow rate. Surface runoff is slow. The seasonal high water table is 1.5 to 3.5 feet below the surface during spring. Available water capacity is high. Organic matter content also is high. The shrink-swell potential is moderate, and the potential for frost action is high.

In most areas this soil is cultivated. It is well suited to

cultivated crops and to pasture and hay. It is poorly suited to dwellings and septic tank absorption fields.

In areas where this soil is used for cultivated crops, measures that lower the seasonal high water table are needed. Subsurface tile drains and surface ditches function satisfactorily if suitable outlets are available. A conservation tillage system that leaves crop residue on the surface after planting helps to maintain tilth and fertility.

The shrink-swell potential is a limitation on sites for dwellings. The seasonal high water table is an additional limitation on sites for dwellings with basements. Adequately reinforcing foundations helps to prevent the structural damage caused by shrinking and swelling. Installing subsurface drains around basement foundations helps to remove excess water.

The moderate permeability and the seasonal high water table are limitations on sites for septic tank absorption fields. Increasing the size of the absorption field helps to overcome the restricted permeability. Installing curtain drains and mounding or raising the absorption field with suitable fill material help to overcome the seasonal high water table.

The land capability classification is I.

171B—Catlin silt loam, 2 to 5 percent slopes. This gently sloping, moderately well drained soil is on ridges on glacial till plains and moraines. Individual areas are irregular in shape and range from 3 to 350 acres in size.

Typically, the surface layer is very dark grayish brown, friable silt loam about 7 inches thick. The subsurface layer is very dark brown, friable silt loam about 5 inches thick. The subsoil is about 39 inches thick. The upper part is dark yellowish brown, friable silty clay loam. The next part is dark yellowish brown, mottled, friable silty clay loam. The lower part is brown, mottled, friable silt loam. The substratum to a depth of 60 inches or more is brown, mottled, firm, calcareous silt loam. In some areas, the subsoil is thinner and calcareous material is closer to the surface. In other areas the soil is moderately eroded. In places the seasonal high water table is within a depth of 3.5 feet. In a few areas the substratum contains less sand.

Included with this soil in mapping are small areas of the poorly drained Drummer and Sable soils and the moderately well drained Varna soils. Drummer and Sable soils are in nearly level areas below the Catlin soil. Varna soils have a higher content of clay throughout the profile than the Catlin soil. They are in landscape positions that are similar to or more sloping than those of the Catlin soil. Included soils make up 2 to 10 percent of the unit.

Water and air move through the Catlin soil at a moderate rate. Surface runoff is medium. The seasonal high water table is 3.5 to 6.0 feet below the surface during late winter and in spring. Available water capacity is high. Organic matter content is moderate. Dense glacial till in the substratum affects the kind and distribution of roots. The shrink-swell potential is moderate, and the potential for frost action is high.

In most areas this soil is cultivated. It is well suited to cultivated crops and to pasture and hay. It is moderately well suited to dwellings. It is poorly suited to septic tank absorption fields.

In areas where this soil is used for cultivated crops, measures that control erosion are needed. Contour farming, grassed waterways, and a conservation tillage system that leaves crop residue on the surface after planting help to control erosion, minimize crusting, and maintain tilth and fertility (fig. 7).

The shrink-swell potential is a limitation on sites for dwellings. The seasonal high water table is an additional limitation on sites for dwellings with basements. Adequately reinforcing foundations helps to prevent the structural damage caused by shrinking and swelling. Installing subsurface drains around basement foundations helps to remove excess water.

The seasonal high water table is a limitation on sites for septic tank absorption fields. Installing curtain drains helps to remove excess water from around the absorption field.

The land capability classification is IIe.

171C2—Catlin silt loam, 5 to 10 percent slopes, eroded. This sloping, moderately well drained soil is on side slopes on glacial till plains and moraines. Individual areas are irregular in shape and range from 3 to 250 acres in size.

Typically, the surface layer is mixed very dark grayish brown and very dark gray, friable silt loam about 8 inches thick. It has been thinned by erosion. The subsoil is about 38 inches thick. The upper part is dark yellowish brown, friable silty clay loam. The next part is brown, mottled, firm silty clay loam. The lower part is brown, mottled, friable silt loam. The substratum to a depth of 60 inches or more is brown, mottled, firm, calcareous clay loam. In some areas the substratum is within a depth of 40 inches. In other areas the lower part of the subsoil and the substratum contain less sand. In places the seasonal high water table is within a depth of 3.5 feet.

Included with this soil in mapping are small areas of the poorly drained Drummer and Sable soils and the moderately well drained Varna soils. Drummer and Sable soils are in nearly level areas below the Catlin soil. Varna soils have a higher content of clay throughout the profile than the Catlin soil. They are in

Figure 7.—A grassed waterway and contour farming in an area of Catlin silt loam, 2 to 5 percent slopes.

landscape positions that are similar to or more sloping than those of the Catlin soil. Included soils make up 5 to 10 percent of the unit.

Water and air move through the Catlin soil at a moderate rate. Surface runoff is medium. The seasonal high water table is 3.5 to 6.0 feet below the surface during late winter and in spring. Available water capacity is high. Organic matter content is moderate. Dense glacial till in the substratum affects the kind and distribution of roots. The shrink-swell potential is moderate, and the potential for frost action is high.

In most areas this soil is cultivated. It is moderately suited to cultivated crops and to dwellings. It is well suited to pasture and hay. It is poorly suited to septic tank absorption fields.

In areas where this soil is used for cultivated crops, measures that control erosion are needed. Contour farming, terraces, grassed waterways, and a conservation tillage system that leaves crop residue on the surface after planting help to control erosion, minimize crusting, and maintain tilth and fertility. A crop rotation that includes forage crops also helps to control erosion.

The shrink-swell potential is a limitation on sites for dwellings. The seasonal high water table is an additional limitation on sites for dwellings with basements. Adequately reinforcing foundations helps to prevent the structural damage caused by shrinking and swelling. Installing subsurface drains around basement foundations helps to remove excess water.

The seasonal high water table is a limitation on sites for septic tank absorption fields. Installing curtain drains helps to remove excess water from around the absorption field.

The land capability classification is IIIe.

194C2—Morley silt loam, 5 to 10 percent slopes, eroded. This sloping, moderately well drained soil is on side slopes on glacial till plains. Individual areas are oblong or irregular in shape and range from 3 to 25 acres in size.

Typically, the surface layer is mixed dark grayish

brown and dark yellowish brown, friable silt loam about 7 inches thick. It has been thinned by erosion. The subsoil is clay loam about 29 inches thick. The upper part is dark yellowish brown and is friable. The lower part is brown, firm, and calcareous. The substratum to a depth of 60 inches or more is brown, mottled, firm, calcareous clay loam. In some areas the surface layer is thinner and contains more clay. In other areas the surface layer is thicker or darker. In places the subsoil contains less clay.

Included with this soil in mapping are small areas of the somewhat poorly drained Blount and Sabina soils and the poorly drained Sawmill soils. Blount soils are on gently sloping ridges above the Morley soil. Sabina soils are on nearly level ridges above the Morley soil. Sawmill soils are on flood plains below the Morley soil. Included soils make up 3 to 7 percent of the unit.

Water and air move through the Morley soil at a slow rate. Surface runoff is medium. The seasonal high water table is perched at a depth of 3 to 6 feet in spring. Available water capacity is high. Organic matter content is moderate. Dense glacial till in the lower part of the subsoil and in the substratum affects the kind and distribution of roots. The shrink-swell potential and the potential for frost action are moderate.

In most areas this soil is cultivated. In some areas it is used for pasture and hay. It is moderately suited to cultivated crops and to dwellings. It is well suited to pasture and hay. It is poorly suited to septic tank absorption fields.

In areas where this soil is used for cultivated crops, measures that control erosion are needed. Contour farming, terraces, grassed waterways, and a conservation tillage system that leaves crop residue on the surface after planting help to control erosion, minimize crusting, and maintain tilth and fertility. A crop rotation that includes forage crops also helps to control erosion.

In areas used as pasture, seeding and renovating on the contour, deferred grazing, stocking at a proper rate, applying fertilizer, and rotation grazing help to control erosion, increase forage production, and prevent surface compaction. A no-till system of seeding also helps to control erosion. Orchardgrass, bromegrass, timothy, alfalfa, and red clover are suitable forage species.

The shrink-swell potential is a limitation on sites for dwellings. The seasonal high water table is an additional limitation on sites for dwellings with basements. Adequately reinforcing foundations helps to prevent the structural damage caused by shrinking and swelling. Installing subsurface drains around basement foundations helps to remove excess water.

The slow permeability and the seasonal high water table are limitations on sites for septic tank absorption fields. Increasing the size of the absorption field helps to overcome the restricted permeability. Installing curtain drains and mounding or raising the absorption field with suitable fill material help to overcome the seasonal high water table.

The land capability classification is IIIe.

194D2—Morley silty clay loam, 10 to 18 percent slopes, eroded. This strongly sloping, well drained soil is on side slopes on glacial till plains. Individual areas are oblong or irregular in shape and range from 5 to 35 acres in size.

Typically, the surface layer is mixed dark brown and brown, friable silty clay loam about 6 inches thick. It has been thinned by erosion. The subsoil is about 38 inches thick. The upper part is brown, firm silty clay. The next part is olive brown, firm, calcareous silty clay. The lower part is olive brown, firm, calcareous clay loam. The substratum to a depth of 60 inches or more is olive brown, firm, calcareous clay loam. In some areas the subsoil and the substratum contain less clay. In other areas the slope is more than 18 percent.

Included with this soil in mapping are small areas of the somewhat poorly drained Blount and poorly drained Sawmill soils. Blount soils are on gently sloping ridges above the Morley soil. Sawmill soils are on flood plains below the Morley soil. Included soils make up 3 to 7 percent of the unit.

Water and air move through the Morley soil at a slow rate. Surface runoff is rapid. Available water capacity is high. Organic matter content is moderate. Dense glacial till in the subsoil and in the substratum affects the kind and distribution of roots. The shrink-swell potential and the potential for frost action are moderate.

In most areas this soil is used for pasture and hay. In some areas it is used for cultivated crops or as woodland. It is moderately suited to pasture and hay and to dwellings. It is poorly suited to cultivated crops and to septic tank absorption fields. It is well suited to woodland and to habitat for woodland wildlife.

In areas where this soil is used for cultivated crops, measures that control erosion are needed. Contour farming, terraces, grassed waterways, and a conservation tillage system that leaves crop residue on the surface after planting help to control erosion, minimize crusting, and maintain tilth and fertility. A crop rotation dominated by forage crops helps to control erosion.

In areas used as pasture, seeding and renovating on the contour, deferred grazing, stocking at a proper rate, applying fertilizer, and rotation grazing help to control erosion, increase forage production, and prevent surface compaction. A no-till system of seeding also

helps to control erosion. Orchardgrass, bromegrass, timothy, alfalfa, and red clover are suitable forage species.

In areas used as woodland, plant competition is a management concern. It hinders the growth of desirable seedlings. The undesirable plants in openings where timber has been harvested can be controlled by chemical or mechanical means. Excluding livestock from the woodland helps to prevent destruction of the leaf mulch and of desirable young trees, compaction of the soil, and damage to tree roots. Measures that protect the woodland from fire are needed.

The shrink-swell potential, the slope, and erosion are management concerns in areas used as sites for dwellings. Adequately reinforcing foundations helps to prevent the structural damage caused by shrinking and swelling. Land shaping may be needed. Maintaining a cover of mulch until plants in newly seeded areas are established helps to control erosion.

The slow permeability is a limitation on sites for septic tank absorption fields. Increasing the size of the absorption field helps to overcome the restricted permeability.

The land capability classification is IVe.

194F—Morley silt loam, 18 to 35 percent slopes. This steep, well drained soil is on side slopes on glacial till plains. Individual areas are long and narrow and range from 5 to 100 acres in size.

Typically, the surface layer is very dark gray, friable silt loam about 3 inches thick. The subsurface layer is dark grayish brown, friable silt loam about 4 inches thick. The subsoil is about 30 inches thick. The upper part is dark grayish brown, friable silty clay loam. The next part is brown, firm silty clay loam. The lower part is olive brown, mottled, firm, calcareous clay loam. The substratum to a depth of 60 inches or more is olive brown, mottled, very firm, calcareous clay loam. In some areas the surface layer is thicker. In other areas the slope is less than 18 percent.

Included with this soil in mapping are small areas of the moderately well drained Birkbeck soils. These soils are on ridges above the Morley soil. They make up 1 to 7 percent of the unit.

Water and air move through the Morley soil at a slow rate. Surface runoff is rapid. Available water capacity is high. Organic matter content is moderate. Dense glacial till in the lower part of the subsoil and in the substratum affects the kind and distribution of roots. The shrink-swell potential and the potential for frost action are moderate.

In most areas this soil is wooded. It is well suited to habitat for woodland wildlife. It is moderately suited to woodland. It is poorly suited to pasture and hay, to dwellings, and to septic tank absorption fields. It generally is unsuited to cultivated crops because of the slope.

In areas where this soil is used as woodland, the slope limits the use of equipment and measures that control erosion are needed. Erosion can be controlled by building logging roads and skid trails on or nearly on the contour, skidding logs or trees uphill with a cable and winch on the steeper slopes, establishing grass firebreaks, and seeding bare areas to grass or to a grass-legume mixture after logging activities have been completed. The use of machinery is limited to periods when the soil is firm. Plant competition hinders the growth of desirable seedlings. The undesirable plants in openings where timber has been harvested can be controlled by chemical or mechanical means. Excluding livestock from the woodland helps to prevent destruction of the leaf mulch and of desirable young trees, compaction of the soil, and damage to tree roots. Measures that protect the woodland from fire are needed.

The development of woodland wildlife habitat on this soil depends on the maintenance of the naturally occurring plant species. The greatest diversity of wildlife species can be achieved by managing for a variety of tree and shrub species. Establishing wildlife food plots and additional cover is difficult because of the slope. Planting on the contour and maintaining a ground cover help to control erosion. Dead trees, fallen logs, and brush piles should be left for cover and nesting sites. Measures that protect the habitat from fire and from grazing by livestock are essential.

The slope and erosion are management concerns in areas used as sites for dwellings. The shrink-swell potential is an additional limitation on sites for dwellings without basements. Land shaping may be needed. Maintaining a cover of mulch until plants in newly seeded areas are established helps to control erosion. Adequately reinforcing foundations helps to prevent the structural damage caused by shrinking and swelling.

The slow permeability and the slope are limitations on sites for septic tank absorption fields. Increasing the size of the absorption field, land shaping, and installing distribution lines across the slope help to overcome these limitations.

The land capability classification is VIe.

200—Orio fine sandy loam. This nearly level, poorly drained soil is in depressions on stream terraces and outwash plains. It is subject to ponding for brief periods from March through June. Individual areas are irregular in shape and range from 2 to 60 acres in size.

Typically, the surface layer is very dark brown, friable fine sandy loam. The subsurface layer is dark grayish

brown, mottled, friable fine sandy loam about 9 inches thick. The subsoil is mottled, friable clay loam about 21 inches thick. The upper part is dark gray. The lower part is grayish brown. The substratum to a depth of 60 inches or more is dark grayish brown, mottled, loose loamy fine sand. In some areas the surface layer and the subsoil contain less sand. In other areas the surface soil is thinner. In places the surface soil is lighter in color.

Included with this soil in mapping are small areas of the somewhat excessively drained Ade and well drained Dakota soils. These soils are in landscape positions that are higher and more sloping than those of the Orio soil. They make up 2 to 5 percent of the unit.

Water and air move through the upper part of the Orio soil at a moderately slow rate and through the lower part at a rapid rate. Surface runoff is slow to ponded. The seasonal high water table is 0.5 foot above the surface to 1.0 foot below during spring. Available water capacity is moderate. Organic matter content is moderately low. The shrink-swell potential is moderate, and the potential for frost action is high.

In most areas this soil is cultivated. It is well suited to cultivated crops and to pasture and hay. It generally is unsuited to dwellings and septic tank absorption fields because of the seasonal high water table and the ponding.

In areas where this soil is used for cultivated crops, measures that lower the seasonal high water table are needed. Maintaining or improving the drainage system helps to maintain productivity. Subsurface drains function satisfactorily if suitable outlets are available. Enclosing the subsurface drains with filter material helps to prevent the accumulation of sand in the tile. Ditches help to remove excess water. Keeping tillage at a minimum and incorporating crop residue into the surface layer minimize crusting and help to maintain tilth and fertility.

The land capability classification is IIw.

205C—Metea loamy fine sand, 5 to 10 percent slopes. This sloping, well drained soil is on side slopes on glacial till plains. Individual areas are irregular in shape and range from 5 to 80 acres in size.

Typically, the surface layer is dark yellowish brown, very friable loamy fine sand about 4 inches thick. The subsurface layer is yellowish brown, very friable loamy fine sand about 19 inches thick. The subsoil is about 17 inches thick. It is yellowish brown. The upper part is very friable sandy loam. The next part is friable sandy clay loam. The lower part is friable loam. The substratum to a depth of 60 inches or more is yellowish brown, friable, calcareous loam. In places the surface layer has been mixed by tillage with the upper part of the subsoil. In some areas the loamy material is below a depth of 40 inches. In other areas the subsoil has more clay.

Included with this soil in mapping are small areas of the somewhat poorly drained Ridgeville and moderately well drained Morley soils. Ridgeville soils are in nearly level areas above the Metea soil. Morley soils have less sand and more clay in the upper part of the profile than the Metea soil. They are in landscape positions similar to those of the Metea soil. Included soils make up 5 to 15 percent of the unit.

Water and air move through the upper part of the Metea soil at a rapid rate and through the lower part at a moderate rate. Surface runoff is medium. Available water capacity is moderate. Organic matter content is low. The shrink-swell potential is low, and the potential for frost action is moderate.

In most areas this soil is cultivated. It is moderately suited to cultivated crops. It is well suited to dwellings. It is poorly suited to septic tank absorption fields.

In areas where this soil is used for cultivated crops, the moderate available water capacity is a limitation and measures that control soil blowing and water erosion are needed. Contour farming, grassed waterways, and a conservation tillage system that leaves crop residue on the surface after planting help to control soil blowing and water erosion and conserve soil moisture. Winter cover crops and field windbreaks also help to control soil blowing. A crop rotation that includes forage crops helps to control erosion. Irrigation systems may be needed because of the moderate available water capacity.

This soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of ground water. Installing a sealed sand filter and a disinfection tank helps to ensure that the septic tank system functions properly.

The land capability classification is IIIe.

205D—Metea loamy fine sand, 10 to 15 percent slopes. This strongly sloping, well drained soil is on side slopes on glacial till plains. Individual areas are irregular in shape and range from 5 to 80 acres in size.

Typically, the surface layer is brown, very friable loamy fine sand about 6 inches thick. The subsurface layer is very friable loamy fine sand about 21 inches thick. The upper part is dark yellowish brown, and the lower part is yellowish brown. The subsoil is about 26 inches thick. The upper part is yellowish brown, friable sandy loam. The lower part is brown, very firm clay loam. The substratum to a depth of 60 inches or more is brown, very firm, calcareous loam. In some areas the very firm loamy material is within a depth of 40 inches.

In other areas the upper part of the subsoil contains more clay.

Included with this soil in mapping are small areas of the poorly drained Sawmill soils. These soils are on flood plains below the Metea soil. They make up 5 to 10 percent of the unit.

Water and air move through the upper part of the Metea soil at a rapid rate and through the lower part at a moderate rate. Surface runoff is medium. Available water capacity is moderate. Organic matter content is low. The shrink-swell potential also is low, and the potential for frost action is moderate.

In most areas this soil is cultivated or used as pasture. It is moderately suited to cultivated crops, to pasture and hay, and to dwellings. It is well suited to woodland. It is poorly suited to septic tank absorption fields.

In areas where this soil is used for cultivated crops, the moderate available water capacity is a limitation and measures that control soil blowing and water erosion are needed. Contour farming, grassed waterways, and a conservation tillage system that leaves crop residue on the surface after planting help to control soil blowing and water erosion and conserve soil moisture. Winter cover crops and field windbreaks also help to control soil blowing. A crop rotation that includes forage crops helps to control erosion. Irrigation systems may be needed because of the moderate available water capacity.

In areas used for pasture and hay, the moderate available water capacity is a limitation and measures that control soil blowing and water erosion are needed. Seeding, rotation grazing, deferred grazing, and applications of fertilizer help to keep the pasture in good condition and help to control soil blowing and water erosion. Irrigation systems may be needed because of the moderate available water capacity. Orchardgrass, bromegrass, timothy, alfalfa, and red clover are suitable forage species.

In the areas used as woodland, plant competition is the main management concern. It hinders the growth of desirable seedlings. The undesirable plants in openings where timber has been harvested can be controlled by chemical or mechanical means. Excluding livestock from the woodland helps to prevent destruction of the leaf mulch and of desirable young trees, compaction of the soil, and damage to tree roots. Measures that protect the woodland from fire are needed.

The slope and erosion are management concerns on sites for dwellings. Land shaping may be needed. Maintaining a cover of mulch until plants in newly seeded areas are established helps to control erosion.

This soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of ground water. Installing a sealed sand filter and a disinfection tank helps to ensure that the septic tank system functions properly.

The land capability classification is IVe.

223B2—Varna silty clay loam, 2 to 5 percent slopes, eroded. This gently sloping, moderately well drained soil is on knolls and ridges on glacial till plains and moraines. Individual areas are irregular in shape and range from 2 to 80 acres in size.

Typically, the surface layer is mixed very dark grayish brown and dark yellowish brown, friable silty clay loam about 8 inches thick. It has been thinned by erosion. The subsoil is about 29 inches thick. It is dark yellowish brown. The upper part is friable silty clay loam. The next part is firm silty clay. The lower part is mottled, very firm, calcareous silty clay. The substratum to a depth of 60 inches or more is dark brown, mottled, very firm, calcareous silty clay. In some areas the surface soil is lighter in color. In other areas the calcareous clayey material is below a depth of 40 inches. In places the surface soil is calcareous.

Included with this soil in mapping are small areas of the poorly drained Sable and Sawmill soils. Sable soils are in nearly level areas and are slightly lower on the landscape than the Varna soil. Sawmill soils are on flood plains below the Varna soil. Included soils make up 1 to 5 percent of the unit.

Water and air move through the Varna soil at a slow rate. Surface runoff is medium. The seasonal high water table is perched at a depth of 3 to 6 feet in spring. Available water capacity is high. Organic matter content is moderate. Dense glacial till in the lower part of the subsoil and in the substratum affects the kind and distribution of roots. The shrink-swell potential is moderate, and the potential for frost action is high.

In most areas this soil is cultivated. It is well suited to cultivated crops and to pasture and hay. It is moderately suited to dwellings. It is poorly suited to septic tank absorption fields.

In areas where this soil is used for cultivated crops, measures that control erosion are needed. Contour farming, grassed waterways, and a conservation tillage system that leaves crop residue on the surface after planting help to control erosion, minimize crusting, and maintain tilth and fertility.

The shrink-swell potential is a limitation on sites for dwellings. The seasonal high water table is an additional limitation on sites for dwellings with basements. Adequately reinforcing foundations helps to prevent the structural damage caused by shrinking and swelling. Installing subsurface drains around basement foundations helps to remove excess water.

The slow permeability and the seasonal high water table are limitations on sites for septic tank absorption fields. Increasing the size of the absorption field helps to overcome the restricted permeability. Installing curtain drains and mounding or raising the absorption field with suitable fill material help to overcome the seasonal high water table.

The land capability classification is IIe.

223C2—Varna silty clay loam, 5 to 10 percent slopes, eroded. This sloping, moderately well drained soil is on side slopes on moraines and glacial till plains. Individual areas are irregular in shape and range from 3 to 60 acres in size.

Typically, the surface layer is mixed very dark grayish brown and dark yellowish brown, friable silty clay loam about 9 inches thick. It has been thinned by erosion. The subsoil is about 22 inches thick. The upper part is dark yellowish brown, firm clay. The lower part is olive brown, mottled, firm, calcareous clay loam. The substratum to a depth of 60 inches or more is olive brown, mottled, firm, calcareous clay loam. In some areas the surface layer is lighter in color. In other areas the calcareous clayey material is below a depth of 40 inches.

Included with this soil in mapping are small areas of the poorly drained Sable and Sawmill soils. Sable soils are in nearly level areas and are slightly lower on the landscape than the Varna soil. Sawmill soils are on flood plains below the Varna soil. Included soils make up 1 to 5 percent of the unit.

Water and air move through the Varna soil at a slow rate. Surface runoff is medium. The seasonal high water table is perched at a depth of 3 to 6 feet in spring. Available water capacity is high. Organic matter content is moderate. Dense glacial till in the substratum affects the kind and distribution of roots. The shrink-swell potential is moderate, and the potential for frost action is high.

In most areas this soil is cultivated. It is moderately suited to cultivated crops, to pasture and hay, and to dwellings. It is poorly suited to septic tank absorption fields.

In areas where this soil is used for cultivated crops, measures that control erosion are needed. Contour farming, terraces, grassed waterways, and a conservation tillage system that leaves crop residue on the surface after planting help to control erosion, minimize crusting, and maintain tilth and fert lity. A crop rotation dominated by forage crops helps to control erosion.

In areas used as pasture, measures that control erosion are needed. A cover of grasses and legumes improves tilth and helps to control erosion. Selection of suitable species for planting, proper stocking rates, rotation grazing, deferred grazing, restricted use during wet periods, and applications of fertilizer help to keep the pasture in good condition. Orchardgrass, bromegrass, timothy, alfalfa, and red clover are suitable forage species.

The shrink-swell potential is a limitation on sites for dwellings. The seasonal high water table is an additional limitation on sites for dwellings with basements. Adequately reinforcing foundations helps to prevent the structural damage caused by shrinking and swelling. Installing subsurface drains around basement foundations helps to remove excess water.

The slow permeability and the seasonal high water table are limitations on sites for septic tank absorption fields. Increasing the size of the absorption field helps to overcome the restricted permeability. Installing curtain drains and mounding or raising the absorption field with suitable fill material help to overcome the seasonal high water table.

The land capability classification is IIIe.

233B—Birkbeck silt loam, 2 to 5 percent slopes. This gently sloping, moderately well drained soil is on ridges on glacial till plains and moraines. Individual areas are oblong or irregular in shape and range from 5 to 200 acres in size.

Typically, the surface layer is brown, friable silt loam about 7 inches thick. The subsoil is about 48 inches thick. The upper part is yellowish brown, friable silty clay loam. The next part is yellowish brown, mottled, friable silty clay loam. The lower part is brown, mottled, firm clay loam. The substratum to a depth of 60 inches or more is brown, firm, calcareous clay loam. In some areas the lower part of the subsoil contains less sand. In other areas clay loam glacial till is within a depth of 40 inches. In places the surface layer is eroded and contains more clay. Some areas on narrow ridges are well drained.

Included with this soil in mapping are small areas of the somewhat poorly drained Sabina and well drained Miami soils. Sabina soils are in nearly level areas below the Birkbeck soil. Miami soils are on the steeper side slopes below the Birkbeck soil. Included soils make up 5 to 15 percent of the unit.

Water and air move through the Birkbeck soil at a moderate rate. Surface runoff is medium. The seasonal high water table is 3 to 6 feet below the surface during spring. Available water capacity is high. Organic matter content is moderately low. Dense glacial till in the lower part of the subsoil and in the substratum affects the kind and distribution of roots. The shrink-swell potential is moderate, and the potential for frost action is high.

In most areas this soil is cultivated. It is well suited to

cultivated crops and to pasture and hay. It is moderately well suited to dwellings. It is poorly suited to septic tank absorption fields.

In areas where this soil is used for cultivated crops, measures that control erosion are needed. Contour farming, grassed waterways, and a conservation tillage system that leaves crop residue on the surface after planting help to control erosion, minimize crusting, and maintain tilth and fertility.

The shrink-swell potential is a limitation on sites for dwellings. The seasonal high water table is an additional limitation on sites for dwellings with basements. Adequately reinforcing foundations helps to prevent the structural damage caused by shrinking and swelling. Installing subsurface drains around basement foundations helps to remove excess water.

The moderately slow permeability and the seasonal high water table are limitations on sites for septic tank absorption fields. Increasing the size of the absorption field helps to overcome the restricted permeability. Installing curtain drains and mounding or raising the absorption field with suitable fill material help to overcome the seasonal high water table.

The land capability classification is IIe.

233C2—Birkbeck silt loam, 5 to 10 percent slopes, eroded. This sloping, moderately well drained soil is on side slopes on glacial till plains and moraines. Individual areas are irregular in shape and range from 3 to 160 acres in size.

Typically, the surface layer is mixed dark brown and dark yellowish brown, friable silt loam about 7 inches thick. It has been thinned by erosion. The subsoil to a depth of more than 60 inches is silty clay loam. The upper part is dark yellowish brown and friable. The next part is yellowish brown, mottled, and friable. The lower part is yellowish brown, mottled, and firm. In some areas carbonates are within a depth of 40 inches. In other areas the surface layer is darker.

Included with this soil in mapping are small areas of the well drained Miami and somewhat poorly drained Sabina soils. Miami soils formed in a thinner layer of silty material over glacial till than the Birkbeck soil. They are on the steeper side slopes below the Birkbeck soil. Sabina soils are in nearly level areas below the Birkbeck soil. Included soils make up 5 to 15 percent of the unit.

Water and air move through the Birkbeck soil at a moderate rate. Surface runoff is medium. The seasonal high water table is 3 to 6 feet below the surface during spring. Available water capacity is high. Organic matter content is moderately low. Dense glacial till in the lower part of the subsoil and in the substratum affects the kind and distribution of roots. The shrink-swell potential is moderate, and the potential for frost action is high.

In most areas this soil is cultivated. It is moderately suited to cultivated crops. It is well suited to pasture and hay. It is moderately suited to dwellings and poorly suited to septic tank absorption fields.

In areas where this soil is used for cultivated crops, measures that control erosion are needed. Contour farming, terraces, grassed waterways, and a conservation tillage system that leaves crop residue on the surface after planting help to control erosion, minimize crusting, and maintain tilth and fertility. A crop rotation that includes forage crops also helps to control erosion.

In areas used as pasture, seeding and renovating on the contour, deferred grazing, stocking at a proper rate, applying fertilizer, and rotation grazing help to control erosion, increase forage production, and prevent surface compaction. A no-till system of seeding also helps to control erosion. Orchardgrass, bromegrass, timothy, alfalfa, and red clover are suitable forage species.

The shrink-swell potential is a limitation on sites for dwellings. The seasonal high water table is an additional limitation on sites for dwellings with basements. Adequately reinforcing foundations helps to prevent the structural damage caused by shrinking and swelling. Installing subsurface drains around basement foundations helps to remove excess water.

The moderately slow permeability and the seasonal high water table are limitations on sites for septic tank absorption fields. Increasing the size of the absorption field helps to overcome the restricted permeability. Installing curtain drains and mounding or raising the absorption field with suitable fill material help to overcome the seasonal high water table.

The land capability classification is IIIe.

236—Sabina silt loam. This nearly level, somewhat poorly drained soil is on broad ridges on glacial till plains. Individual areas are irregular in shape and range from 5 to 150 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 7 inches thick. The subsurface layer is dark grayish brown, mottled, friable silt loam about 7 inches thick. The subsoil is silty clay loam about 39 inches thick. It is friable and mottled. The upper part is dark grayish brown, and the lower part is brown. The substratum to a depth of 60 inches or more is brown, mottled, friable, calcareous clay loam. In some areas the subsoil is thinner. In other areas the substratum contains less sand. In a few places the surface layer is darker.

Included with this soil in mapping are small areas of the moderately well drained Birkbeck soils. These soils

are in the more sloping areas below the Sabina soil. They make up 2 to 10 percent of the unit.

Water and air move through the Sabina soil at a moderately slow rate. Surface runoff is slow. The seasonal high water table is 1.5 to 3.5 feet below the surface during spring. Available water capacity is high. Organic matter content is moderately low. The shrink-swell potential and the potential for frost action are high.

In most areas this soil is cultivated. It is well suited to cultivated crops and to pasture and hay. It is poorly suited to dwellings and septic tank absorption fields.

If this soil is used for cultivated crops, measures that lower the seasonal high water table are needed. Subsurface drains and surface ditches function satisfactorily if suitable outlets are available. Keeping tillage at a minimum and incorporating crop residue into the surface layer minimize crusting and help to maintain tilth and fertility.

The shrink-swell potential is a limitation on sites for dwellings. The seasonal high water table is an additional limitation on sites for dwellings with basements. Adequately reinforcing foundations helps to prevent the structural damage caused by shrinking and swelling. Installing subsurface drains around basement foundations helps to remove excess water.

The moderately slow permeability and the seasonal high water table are limitations on sites for septic tank absorption fields. Increasing the size of the absorption field helps to overcome the restricted permeability. Installing curtain drains and mounding or raising the absorption field with suitable fill material help to overcome the seasonal high water table.

The land capability classification is IIw.

278—Stronghurst silt loam. This nearly level, somewhat poorly drained soil is on broad ridges on glacial till plains. Individual areas are irregular in shape and range from 5 to 90 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 8 inches thick. The subsurface layer is dark grayish brown, mottled, friable silt loam about 4 inches thick. The subsoil extends to a depth of more than 60 inches. It is mottled. The upper part is brown, firm silty clay loam. The next part is grayish brown, firm silty clay loam. The lower part is grayish brown, friable silt loam. In some areas the surface layer is darker. In other areas the seasonal high water table is more than 3 feet below the surface.

Included with this soil in mapping are small areas of the well drained Fayette soils. These soils are in the more sloping areas below the Stronghurst soil. They make up 1 to 5 percent of the unit.

Water and air move through the Stronghurst soil at a moderate rate. Surface runoff is slow. The seasonal high water table is 1 to 3 feet below the surface during spring. Available water capacity is very high. Organic matter content is moderately low. The shrink-swell potential is moderate, and the potential for frost action is high.

In most areas this soil is cultivated. It is well suited to cultivated crops and to pasture and hay. It is poorly suited to dwellings and septic tank absorption fields.

In areas where this soil is used for cultivated crops, measures that lower the seasonal high water table are needed. Subsurface drains and surface ditches function satisfactorily if suitable outlets are available. Keeping tillage at a minimum and incorporating crop residue into the surface layer minimize crusting and help to maintain tilth and fertility.

The seasonal high water table is a limitation on sites for dwellings. The shrink-swell potential is an additional limitation on sites for dwellings without basements. Installing subsurface drains around foundations helps to remove excess water. Adequately reinforcing foundations helps to prevent the structural damage caused by shrinking and swelling.

The seasonal high water table is a limitation on sites for septic tank absorption fields. Installing curtain drains and mounding or raising the absorption field with suitable fill material help to overcome this limitation.

The land capability classification is IIw.

279B—Rozetta silt loam, 2 to 5 percent slopes. This gently sloping, moderately well drained soil is on ridges and side slopes on glacial till plains. Individual areas are irregular in shape and range from 5 to 200 acres in size.

Typically, the surface layer is mixed dark brown and brown, friable silt loam about 9 inches thick. The subsoil extends to a depth of more than 60 inches. It is friable. The upper part is dark yellowish brown silty clay loam. The next part is dark yellowish brown, mottled silty clay loam. The lower part is yellowish brown, mottled silt loam. In some areas the surface layer is darker. In other areas the lower part of the subsoil contains more sand.

Included with this soil in mapping are small areas of the somewhat poorly drained Stronghurst soils. These soils are in nearly level areas above the Rozetta soil. They make up 5 to 10 percent of the unit.

Water and air move through the Rozetta soil at a moderate rate. Surface runoff is medium. The seasonal high water table is 4 to 6 feet below the surface during spring. Available water capacity is high. Organic matter content is moderately low. The shrink-swell potential is moderate, and the potential for frost action is high.

In most areas this soil is cultivated. It is well suited to cultivated crops and to pasture and hay. It is

moderately suited to dwellings and septic tank absorption fields.

In areas where this soil is used for cultivated crops, measures that control erosion are needed. Contour farming, grassed waterways, and a conservation tillage system that leaves crop residue on the surface after planting help to control erosion, minimize crusting, and maintain tilth and fertility.

The shrink-swell potential is a limitation on sites for dwellings. The seasonal high water table is an additional limitation on sites for dwellings with basements. Adequately reinforcing foundations helps to prevent the structural damage caused by shrinking and swelling. Installing subsurface drains around basement foundations helps to remove excess water.

The seasonal high water table is a limitation on sites for septic tank absorption fields. Installing curtain drains helps to remove excess water from around the absorption field.

The land capability classification is IIe.

280C2—Fayette silt loam, 5 to 10 percent slopes, eroded. This sloping, well drained soil is on side slopes on glacial till plains. Individual areas are irregular in shape or oblong and range from 5 to 80 acres in size.

Typically, the surface layer is mixed dark grayish brown and yellowish brown, friable silt loam about 6 inches thick. It has been thinned by erosion. The subsoil extends to a depth of more than 60 inches. It is yellowish brown and friable. The upper part is silty clay loam. The next part is mottled silty clay loam. The lower part is mottled silt loam. In some areas the lower part of the subsoil contains more sand. In other areas the surface layer is darker.

Included with this soil in mapping are small areas of the somewhat poorly drained Stronghurst soils. These soils are in nearly level areas on ridges above the Fayette soil. They make up about 5 to 10 percent of the unit.

Water and air move through the Fayette soil at a moderate rate. Surface runoff is medium. Available water capacity is high. Organic matter content is moderately low. The shrink-swell potential is moderate, and the potential for frost action is high.

In most areas this soil is cultivated. In some areas it is used for pasture and hay. It is moderately suited to cultivated crops. It is well suited to pasture and hay and to septic tank absorption fields. It is moderately suited to dwellings.

In areas where this soil is used for cultivated crops, measures that control erosion are needed. Contour farming, terraces, grassed waterways, and a conservation tillage system that leaves crop residue on the surface after planting help to control erosion, minimize crusting, and maintain tilth and fertility. A crop rotation that includes forage crops also helps to control erosion.

In areas used as pasture, seeding and renovating on the contour, deferred grazing, stocking at a proper rate, applying fertilizer, and rotation grazing help to control erosion, increase forage production, and prevent surface compaction. A no-till system of seeding also helps to control erosion. Orchardgrass, bromegrass, timothy, alfalfa, and red clover are suitable forage species.

The shrink-swell potential is a limitation on sites for dwellings. Adequately reinforcing foundations helps to prevent the structural damage caused by shrinking and swelling.

The land capability classification is IIIe.

359D—Fayette silt loam, till substratum, 10 to 15 percent slopes. This strongly sloping, well drained soil is on side slopes on glacial till plains. Individual areas are irregular in shape and range from 3 to 120 acres in size.

Typically, the surface layer is dark grayish brown, friable silt loam about 5 inches thick. The subsurface layer is brown, friable silt loam about 6 inches thick. The subsoil is friable silty clay loam about 45 inches thick. The upper part is dark yellowish brown. The lower part is yellowish brown and is mottled. The substratum to a depth of 60 inches or more is light yellowish brown, friable, calcareous loam. In some areas the silty subsoil extends to a depth of more than 60 inches. In other areas the till substratum is within a depth of 40 inches. In places the surface soil is moderately eroded and has pockets of material from the upper part of the subsoil.

Water and air move through this soil at a moderate rate. Surface runoff is rapid. Available water capacity is high. Organic matter content is moderately low. The shrink-swell potential is moderate, and the potential for frost action is high.

In most areas this soil is wooded. It is well suited to woodland and to habitat for woodland wildlife. It is moderately suited to cultivated crops, to pasture and hay, and to dwellings and septic tank absorption fields.

If this soil is used for cultivated crops, measures that control erosion are needed. Contour farming, terraces, grassed waterways, and a conservation tillage system that leaves crop residue on the surface after planting help to control erosion, minimize crusting, and maintain tilth and fertility. A crop rotation dominated by forage crops helps to control erosion.

In areas used as pasture, seeding and renovating on the contour, deferred grazing, stocking at a proper rate, applying fertilizer, and rotation grazing help to control erosion, increase forage production, and prevent

surface compaction. A no-till system of seeding also helps to control erosion. Orchardgrass, bromegrass, timothy, alfalfa, and red clover are suitable forage species.

In areas used as woodland, plant competition is a management concern. It hinders the growth of desirable seedlings. The undesirable plants in openings where timber has been harvested can be controlled by chemical or mechanical means. Excluding livestock from the woodland helps to prevent destruction of the leaf mulch and of desirable young trees, compaction of the soil, and damage to tree roots. Measures that protect the woodland from fire are needed.

The development of woodland wildlife habitat on this soil depends on the maintenance of the naturally occurring plant species. The greatest diversity of wildlife species can be achieved by managing for a variety of tree and shrub species. Planting on the contour and maintaining a ground cover help to control erosion. Dead trees, fallen logs, and brush piles should be left for cover and nesting sites. Measures that protect the habitat from fire and from grazing by livestock are essential.

The shrink-swell potential, the slope, and erosion are management concerns in areas used as sites for dwellings. Adequately reinforcing foundations helps to prevent the structural damage caused by shrinking and swelling. Land shaping may be needed. Maintaining a cover of mulch until plants in newly seeded areas are established helps to control erosion.

The slope is a limitation on sites for septic tank absorption fields. Land shaping and installing the distribution lines across the slope help to overcome this limitation.

The land capability classification is IIIe.

379A—Dakota loam, 0 to 2 percent slopes. This nearly level, well drained soil is on stream terraces. Individual areas are irregular in shape and range from 5 to 150 acres in size.

Typically, the surface layer is very dark grayish brown, friable loam about 10 inches thick. The subsurface layer is very dark grayish brown, friable silt loam about 5 inches thick. The subsoil is about 20 inches thick. The upper part is brown, friable clay loam. The next part is dark yellowish brown, friable clay loam. The lower part is dark yellowish brown, very friable loamy sand. The substratum to a depth of 60 inches or more is yellowish brown, loose sand. In some areas the substratum contains more clay and less sand. In other areas the surface layer and the subsoil contain more sand and less clay. In a few places the surface layer is lighter in color.

Water and air move through the upper part of this soil at a moderate rate and through the lower part at a rapid rate. Surface runoff is slow. Available water capacity is moderate. Organic matter content also is moderate. The shrink-swell potential is low, and the potential for frost action is moderate.

In most areas this soil is cultivated. It is well suited to cultivated crops and to dwellings. It is poorly suited to septic tank absorption fields.

In areas where this soil is used for cultivated crops, the moderate available water capacity is a limitation. A conservation tillage system that leaves crop residue on the surface after planting helps to minimize crusting, helps to maintain tilth and fertility, and conserves soil moisture. Irrigation systems may be needed because of the moderate available water capacity.

This soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of ground water. Installing a sealed sand filter and a disinfection tank helps to ensure that the septic tank system functions properly.

The land capability classification is IIs.

379B2—Dakota loam, 2 to 5 percent slopes, eroded. This gently sloping, well drained soil is on stream terraces. Individual areas are irregular in shape and range from 5 to 250 acres in size.

Typically, the surface layer is mixed dark brown and brown, friable loam about 9 inches thick. It has been thinned by erosion. The subsoil is about 26 inches thick. The upper part is dark brown, friable clay loam. The next part is dark yellowish brown, friable clay loam. The lower part is dark yellowish brown, very friable loamy sand. The substratum to a depth of 60 inches or more is yellowish brown, loose sand that has bands of dark yellowish brown loamy sand. In some areas the surface layer and the subsoil contain more sand. In other areas the substratum contains more clay and less sand.

Included with this soil in mapping are small areas of the somewhat poorly drained Ridgeville and poorly drained Orio soils. Ridgeville soils contain more sand in the subsoil than the Dakota soil. They are in nearly level areas downslope from the Dakota soil. Orio soils are in depressions. Included soils make up 5 to 10 percent of the unit.

Water and air move through the upper part of the Dakota soil at a moderate rate and through the lower part at a rapid rate. Surface runoff is medium. Available water capacity is moderate. Organic matter content also is moderate. The shrink-swell potential is low, and the potential for frost action is moderate.

In most areas this soil is cultivated. It is well suited to cultivated crops, to pasture and hay, and to dwellings. It

is poorly suited to septic tank absorption fields.

In areas where this soil is used for cultivated crops, the moderate available water capacity is a limitation and measures that control erosion are needed. Contour farming, grassed waterways, and a conservation tillage system that leaves crop residue on the surface after planting help to control erosion, conserve soil moisture, minimize crusting, and maintain tilth and fertility. Irrigation systems may be needed because of the moderate available water capacity.

This soil readily absorbs but does not adequately filter the effluent in septic tank absorption fields. The poor filtering capacity can result in the pollution of ground water. Installing a sealed sand filter and a disinfection tank helps to ensure that the septic tank system functions properly.

The land capability classification is IIe.

386B—Downs silt loam, 2 to 5 percent slopes. This gently sloping, moderately well drained soil is on ridges and side slopes on glacial till plains. Individual areas are irregular in shape and range from 5 to 150 acres in size.

Typically, the surface layer is very dark brown, friable silt loam about 8 inches thick. The subsoil is about 43 inches thick. It is friable. The upper part is brown silt loam. The next part is dark yellowish brown silty clay loam. The lower part is yellowish brown, mottled silt loam. The substratum to a depth of 60 inches or more is yellowish brown, mottled, friable, calcareous silt loam. In some areas the surface layer is thinner and lighter in color. In other areas it is thicker and darker. In places the seasonal high water table is within a depth of 4 feet. In a few areas the slope is more than 5 percent.

Included with this soil in mapping are small areas of the somewhat poorly drained Stronghurst soils. These soils have a light colored surface layer. They are in nearly level areas above the Downs soil. They make up 5 to 10 percent of the unit.

Water and air move through the Downs soil at a moderate rate. Surface runoff is medium. The seasonal high water table is 4 to 6 feet below the surface during spring. Available water capacity is high. Organic matter content is moderate. The shrink-swell potential also is moderate, and the potential for frost action is high.

In most areas this soil is cultivated. It is well suited to cultivated crops and to pasture and hay. It is moderately suited to dwellings and septic tank absorption fields.

In areas where this soil is used for cultivated crops, measures that control erosion are needed. Contour farming, grassed waterways, and a conservation tillage system that leaves crop residue on the surface after planting help to control erosion, minimize crusting, and maintain tilth and fertility.

The shrink-swell potential is a limitation on sites for dwellings. The seasonal high water table is an additional limitation on sites for dwellings with basements. Adequately reinforcing foundations helps to prevent the structural damage caused by shrinking and swelling. Installing subsurface drains around basement foundations helps to remove excess water.

The seasonal high water table is a limitation on sites for septic tank absorption fields. Installing curtain drains helps to remove excess water from around the absorption field.

The land capability classification is IIe.

398A—Wea silt loam, 0 to 2 percent slopes. This nearly level, well drained soil is on stream terraces. Individual areas are irregular in shape and range from 5 to 350 acres in size.

Typically, the surface soil is very dark grayish brown, friable silt loam about 15 inches thick. The subsoil is about 28 inches thick. It is friable. The upper part is brown clay loam. The next part is dark brown clay loam. The lower part is dark brown, calcareous very gravelly loam. The substratum to a depth of 60 inches or more is brown, loose, calcareous very gravelly loamy coarse sand. In some areas the subsoil contains less sand. In other areas the substratum contains less gravel and is below a depth of 60 inches.

Included with this soil in mapping are small areas of the excessively drained Rodman soils. These soils have less clay and more sand and gravel in the upper part than the Wea soil. They are in the more sloping areas above the Wea soil. They make up 2 to 10 percent of the unit.

Water and air move through the upper part of the Wea soil at a moderate rate and through the lower part at a very rapid rate. Surface runoff is slow. Available water capacity is high. Organic matter content is moderate. The shrink-swell potential and the potential for frost action are moderate.

In most areas this soil is cultivated. It is well suited to cultivated crops and to septic tank absorption fields. It is moderately suited to dwellings.

No major limitations affect the use of this soil for cultivated crops. Keeping tillage at a minimum and incorporating crop residue into the surface layer minimize crusting and maintain tilth and fertility.

The shrink-swell potential is a limitation on sites for dwellings. Adequately reinforcing foundations helps to prevent the structural damage caused by shrinking and swelling.

The land capability classification is I.

398B—Wea silt loam, 2 to 5 percent slopes. This gently sloping, well drained soil is on stream terraces. Individual areas are irregular in shape and range from 5 to 300 acres in size.

Typically, the surface soil is very dark grayish brown, friable silt loam about 14 inches thick. The subsoil is about 26 inches thick. The upper part is brown, friable silty clay loam. The next part is brown, friable clay loam. The lower part is dark brown, very firm very gravelly clay loam. The substratum to a depth of 60 inches or more is dark yellowish brown, loose, calcareous very gravelly sandy loam. In some areas the subsoil has less sand. In other areas the substratum contains less gravel and is deeper. In places the surface soil is thinner and contains pockets of material from the upper part of the subsoil.

Included with this soil in mapping are small areas of the excessively drained Rodman soils. These soils have less clay and more sand in the upper part than the Wea soil. They are in the more sloping areas below the Wea soil. They make up 2 to 10 percent of the unit.

Water and air move through the upper part of the Wea soil at a moderate rate and through the lower part at a very rapid rate. Surface runoff is medium. Available water capacity is high. Organic matter content is moderate. The shrink-swell potential and the potential for frost action are moderate.

In most areas this soil is cultivated. It is well suited to cultivated crops and to septic tank absorption fields. It is moderately suited to dwellings.

In areas where this soil is used for cultivated crops, measures that control erosion are needed. Contour farming, grassed waterways, and a conservation tillage system that leaves crop residue on the surface after planting help to control erosion, minimize crusting, and maintain tilth and fertility.

The shrink-swell potential is a limitation on sites for dwellings. Adequately reinforcing foundations helps to prevent the structural damage caused by shrinking and swelling.

The land capability classification is IIe.

533—Urban land. This map unit consists of areas covered by buildings and pavement. These areas have been altered by cutting and filling during industrial development. More than 85 percent of the unit is paved areas and buildings. The paved areas are mainly parking lots around industrial plants. Areas of this unit generally are nearly level to sloping. They are rectangular.

Surface runoff generally is very rapid. The paved areas commonly conduct runoff into a storm drainage system. Some of the runoff causes erosion on the adjacent soils.

Vegetated areas make up less than 15 percent of the map unit. They are mainly grassed borders and widely spaced areas of trees and shrubs. Various species of weeds and grasses are on idle land along the edge of the developed areas.

This map unit is not assigned a land capability classification.

536—Dumps, mine. This map unit consists of nearly level to very steep piles of refuse discarded after the washing and separation of coal. Individual areas are irregularly shaped or fan shaped and range from 28 to 50 acres in size.

The material in this unit consists of shale. Some of the material is weathered to clay loam, silty clay loam, or the shaly analogs of those textures. The material is dominantly red and gray but in some areas is bright red. It is very strongly acid or extremely acid.

Included in this unit are escarpment cuts adjacent to undisturbed soils. Also included are small areas of water and escarpment cuts.

Surface runoff is ponded to very rapid on this unit. The material is compacted and is easily eroded. Because of extreme acidity, runoff is toxic to most plants. The nearly level areas are wet for long periods. Organic matter content is very low.

Most of the acreage is idle land. Except for a few trees that are tolerant of high acidity, this unit supports little vegetation.

If reclaimed, this map unit can be used for recreational areas, such as shooting ranges and paths and trails. The major limitations are wetness in the nearly level areas and erosion and toxic runoff in the more sloping areas. Holding ponds can keep the toxic runoff from entering drainageways or areas of deep water and from running onto cropland. Reclamation would involve grading, shaping, and covering the areas with soil that can support vegetation. The feasibility and extent of reclamation depend on conditions determined by onsite investigation and on the particular use intended.

This map unit is not assigned a land capability classification.

552—Drummer silty clay loam, till substratum. This nearly level, poorly drained soil is on broad ridges on glacial till plains. It is occasionally ponded for brief periods in winter and early spring. Individual areas are irregular in shape and range from 5 to 200 acres in size.

Typically, the surface layer is black, friable silty clay loam about 8 inches thick. The subsurface layer is black, friable silty clay loam about 4 inches thick. The subsoil is about 47 inches thick. It is mottled. The upper

part is dark grayish brown, friable silty clay loam. The next part is grayish brown, friable silty clay loam. The lower part is gray, firm loam. The substratum to a depth of 60 inches or more is light olive brown, mottled, firm loam. In some areas the upper part of the subsoil is darker and contains more clay. In other areas the substratum is stratified, loamy glacial outwash.

Included with this soil in mapping are small areas of the poorly drained Harpster soils. These soils are calcareous throughout. They are in landscape positions similar to those of the Drummer soil. They make up 2 to 10 percent of the unit.

Water and air move through the Drummer soil at a moderately slow rate. Surface runoff is slow to ponded. The seasonal high water table is 0.5 foot above the surface to 2.0 feet below during spring. Available water capacity is high. Organic matter content also is high. The shrink-swell potential is moderate, and the potential for frost action is high.

In most areas this soil is cultivated. It is well suited to cultivated crops and to pasture and hay. It generally is unsuited to dwellings and septic tank absorption fields because of the ponding and the moderately slow permeability.

In areas where this soil is used for cultivated crops, measures that lower the water table and control ponding are needed. Maintaining or improving the drainage system helps to maintain productivity. Subsurface drains function satisfactorily if suitable outlets are available. Ditches help to remove excess water. Keeping tillage at a minimum and incorporating crop residue into the surface layer minimize crusting and help to maintain tilth and fertility.

The land capability classification is IIw.

570A—Martinsville loam, 0 to 2 percent slopes. This nearly level, well drained soil is on stream terraces. Individual areas are irregular in shape and range from 3 to 80 acres in size.

Typically, the surface layer is brown, friable loam about 6 inches thick. The subsoil extends to a depth of more than 60 inches. The upper part is dark yellowish brown, friable clay loam. The next part is dark yellowish brown, friable sandy clay loam. The lower part is brown, very friable loamy sand that has bands of dark brown sandy loam. In some areas the upper part of the subsoil contains less sand. In other areas the lower part of the subsoil and the substratum contain gravel. In places the surface layer is darker.

Water and air move through this soil at a moderate rate. Surface runoff is slow. Available water capacity is high. Organic matter content is moderately low. The shrink-swell potential and the potential for frost action are moderate.

In most areas this soil is cultivated. It is well suited to cultivated crops, to pasture and hay, to dwellings with basements, and to septic tank absorption fields. It is moderately suited to dwellings without basements.

No major limitations affect the use of this soil for cultivated crops. Keeping tillage at a minimum and incorporating crop residue into the surface layer minimize crusting and maintain tilth and fertility.

The shrink-swell potential is a limitation on sites for dwellings without basements. Adequately reinforcing foundations helps to prevent the structural damage caused by shrinking and swelling.

The land capability classification is I.

570C—Martinsville fine sandy loam, 5 to 10 percent slopes. This sloping, well drained soil is on the side slopes of stream terraces. Individual areas are irregular in shape and range from 5 to 35 acres in size.

Typically, the surface layer is mixed very dark grayish brown and very dark brown, friable fine sandy loam about 5 inches thick. The subsurface layer is brown, friable loam about 4 inches thick. The subsoil is about 47 inches thick. It is friable. The upper part is brown clay loam. The next part is brown sandy clay loam. The lower part is brown sandy loam. The substratum to a depth of 60 inches or more is brown, friable, calcareous sandy loam. In some areas the upper part of the subsoil contains less sand. In other areas the lower part of the subsoil and the substratum contain gravel. In places the slope is less than 5 percent.

Included with this soil in mapping are small areas of the excessively drained Rodman soils. These soils contain gravel throughout. They are downslope from the Martinsville soil. They make up 5 to 10 percent of the unit.

Water and air move through the Martinsville soil at a moderate rate. Surface runoff is medium. Available water capacity is high. Organic matter content is moderately low. The shrink-swell potential and the potential for frost action are moderate.

In most areas this soil is cultivated. It is moderately suited to cultivated crops. It is well suited to pasture and hay, to septic tank absorption fields, and to dwellings with basements. It is moderately suited to dwellings without basements.

In areas where this soil is used for cultivated crops, measures that control erosion are needed. Contour farming, terraces, grassed waterways, and a conservation tillage system that leaves crop residue on the surface after planting help to control erosion, minimize crusting, and maintain tilth and fertility. A crop rotation that includes forage crops also helps to control erosion.

In areas used as pasture, seeding and renovating on the contour, deferred grazing, stocking at a proper rate, applying fertilizer, and rotation grazing help to control erosion, increase forage production, and prevent surface compaction. A no-till system of seeding also helps to control erosion. Orchardgrass, bromegrass, timothy, alfalfa, and red clover are suitable forage species.

The shrink-swell potential is a limitation on sites for dwellings without basements. Adequately reinforcing foundations helps to prevent the structural damage caused by shrinking and swelling.

The land capability classification is IIIe.

587B—Terril loam, 1 to 7 percent slopes. This gently sloping, well drained soil is on alluvial fans. Individual areas are irregular in shape and range from 2 to 40 acres in size.

Typically, the surface soil is dark brown, friable loam about 30 inches thick. The subsoil to a depth of more than 60 inches is dark yellowish brown, friable loam. In some areas the seasonal high water table is within a depth of 6 feet. In other areas the soil has more gravel throughout. In some places the surface soil and the upper part of the subsoil contain less sand. In other places the slope is less than 1 percent. In some areas the lower part of the subsoil contains more sand and less clay.

Included with this soil in mapping are small areas of the excessively drained Rodman and poorly drained Moundprairie soils. Rodman soils are on side slopes above the Terril soil. Moundprairie soils are on flood plains below the Terril soil. Included soils make up 5 to 10 percent of the unit.

Water and air move through the Terril soil at a moderate rate. Surface runoff is medium. Available water capacity is high. Organic matter content also is high. The shrink-swell potential is low, and the potential for frost action is moderate.

In most areas this soil is cultivated. It is well suited to cultivated crops, to pasture and hay, to dwellings, and to septic tank absorption fields.

In areas where this soil is used for cultivated crops, measures that control erosion are needed. Contour farming, grassed waterways, and a conservation tillage system that leaves crop residue on the surface after planting help to control erosion, minimize crusting, and maintain tilth and fertility.

The land capability classification is IIe.

802B—Orthents, loamy, undulating. These soils are in areas where the landscape has been disturbed by cutting, filling, and leveling. Slopes range from 1 to 7 percent. Individual areas are square, rectangular, or irregular in shape and range from 5 to 200 acres in size.

Typically, these soils have layers of loam, gravelly loam, sandy loam, or gravelly sandy loam that are commonly 2 to more than 5 feet thick. In most areas they are underlain by sand and gravel. In some areas refuse and other nonsoil material are incorporated into the soils. In other areas slopes are more than 7 percent. In places the soils contain more sand and gravel throughout.

Included with these soils in mapping are small areas of the excessively drained Rodman and well drained Wea soils and disturbed areas of poorly drained soils in depressions that are subject to ponding or are in drainageways. Rodman and Wea soils are in undisturbed areas. Rodman soils are gravelly throughout. Wea soils are loamy in the upper part and gravelly in the lower part. Also included are areas where buildings, streets, and parking lots cover as much as 65 percent of the surface. Included areas make up 15 to 18 percent of the unit.

Water and air move through the Orthents at a varying rate because of compaction by construction equipment and varying soil textures. Surface runoff is medium. Available water capacity generally is moderate. Organic matter content is low.

Most of the acreage is idle land in residential and industrial areas, near interstate interchanges, along railroads, and in fill areas. Some areas have been developed for recreational uses or wildlife habitat. These soils are moderately suited to dwellings and small commercial buildings. They are poorly suited to septic tank absorption fields because of a poor filtering capacity and the content of nonsoil material. They are moderately suited to recreational uses and to habitat for wildlife. Cut and filled areas are subject to uneven settling. Mixing and compacting the base material on building sites helps to overcome this limitation. Some newly exposed areas do not have a plant cover, and some developed areas have a good cover of sod. Unless a good plant cover protects the surface, erosion is a hazard. Establishing and maintaining the plant cover help to control runoff and erosion.

Seeding a mixture of grasses and legumes that are suited to a wide range of soil conditions helps to establish desirable vegetation. Fertilizer and organic residue are needed for optimum growth. Onsite investigation is needed to determine the limitations or hazards affecting the development of individual areas for specific uses.

This map unit is not assigned a land capability classification.

819G—Hennepin-Vanmeter complex, 30 to 60 percent slopes. These very steep soils are on side slopes on glacial till plains. The moderately deep, moderately well drained Vanmeter soil is on the lower parts of the side slopes below the deep, well drained Hennepin soil. Individual areas of this unit are long and irregular in shape and range from 5 to 200 acres in size. They are about 50 to 70 percent Hennepin soil and 30 to 40 percent Vanmeter soil. The two soils occur as areas so small and narrow that mapping them separately is not practical.

Typically, the surface layer of the Hennepin soil is dark yellowish brown, friable, calcareous loam about 4 inches thick. The subsoil is about 10 inches thick. It is brown, friable, and calcareous. The upper part is clay loam. The lower part is loam. The substratum to a depth of 60 inches or more is brown, friable, calcareous loam.

Typically, the surface layer of the Vanmeter soil is dark grayish brown, friable, calcareous silty clay loam about 3 inches thick. The subsoil is about 34 inches thick. The upper part is dark yellowish brown, friable, calcareous silty clay. The next part is light olive brown, firm, calcareous clay. The lower part is olive gray, firm, calcareous clay. Below this to a depth of 60 inches or more is olive gray, firm, calcareous shale. In some areas the depth to calcareous shale is more than 40 inches.

Included with these soils in mapping are small areas of the well drained Miami soils. These included soils are more acid in the upper part than the Hennepin and Vanmeter soils. Also, they are higher on the landscape. They make up 5 to 10 percent of the unit.

Water and air move through the Hennepin soil at a moderately slow rate and through the Vanmeter soil at a very slow rate. Surface runoff is very rapid on both soils. Available water capacity is moderate in the Hennepin soil and low in the Vanmeter soil. Organic matter content is moderately low in both soils. Dense clay in the lower part of the subsoil and the underlying shale restrict the root zone in the Vanmeter soil. The shrink-swell potential is low in the Hennepin soil and high in the Vanmeter soil. The potential for frost action is moderate in both soils.

In most areas these soils are used as woodland. The Hennepin soil is well suited to habitat for woodland wildlife, and the Vanmeter soil is moderately suited. Both soils are moderately suited to woodland. They generally are unsuited to cultivated crops, to pasture and hay, to dwellings, and to septic tank absorption fields because of the slope.

In areas where these soils are used as woodland, the slope limits the use of equipment and measures that control erosion are needed. Erosion can be controlled by building logging roads and skid trails on or nearly on the contour, skidding logs or trees uphill with a cable and winch on the steeper slopes, establishing grass firebreaks, and seeding bare areas to grass or to a grass-legume mixture after logging activities have been completed. The use of machinery is limited to periods when the soils are firm. Plant competition hinders the growth of desirable seedlings. The undesirable plants in openings where timber has been harvested can be controlled by chemical or mechanical means. Excluding livestock from the woodland helps to prevent destruction of the leaf mulch and of desirable young trees, compaction of the soil, and damage to tree roots. Measures that protect the woodland from fire are needed.

Seedling mortality and windthrow are additional management concerns on the Vanmeter soil. Seedling mortality is caused by the low available water capacity. The seedling mortality rate can be reduced by planting nursery stock that is larger than is typical, by planting in furrows, or by mulching. Harvesting methods that do not isolate the remaining trees or leave them widely spaced reduce the hazard of windthrow.

The development of woodland wildlife habitat on these soils depends on the maintenance of the naturally occurring plant species. The greatest diversity of wildlife species can be achieved by managing for a variety of tree and shrub species. Establishing wildlife food plots and additional cover is difficult because of the slope. Planting on the contour and maintaining a ground cover help to control erosion. Dead trees, fallen logs, and brush piles should be left for cover and nesting sites. Measures that protect the habitat from fire and from grazing by livestock are essential.

The land capability classification is VIIe.

865—Pits, gravel. This map unit consists of excavations from which gravel and sand have been removed. It includes disturbed areas around the excavations. The pits are on outwash plains and stream terraces. They are 5 to 50 acres in size.

The soil material in this map unit is sandy and gravelly. The excavations are 10 to 80 feet deep. They support little or no vegetation. The pits that are filled with water are indicated as water on the soil maps.

Included in this unit in mapping are small areas of Orthents, which support vegetation. These soils are in areas where mine spoil has been mixed with soil material from around the pits. They make up 2 to 8 percent of the unit.

Water and air move through the soil material in the pits at a rapid or very rapid rate. Available water capacity is very low. Organic matter content also is very low.

Most areas are mined for sand and gravel. Some abandoned areas are developed for recreational uses. This unit is moderately suited to recreational uses. It is poorly suited to sanitary landfills. The pits that are filled with water can be stocked with fish. Planting trees improves the suitability for recreational uses. Topdressing with suitable soil material and grading the disturbed areas help to establish vegetation.

This map unit is not assigned a land capability classification.

1480—Moundprairie silty clay loam, wet. This nearly level, poorly drained soil is on flood plains. It is saturated throughout the growing season and is frequently flooded from March through June. Individual areas are irregular in shape and range from 20 to 1,000 acres in size.

Typically, the surface layer is very dark gray, friable, calcareous silty clay loam about 13 inches thick. The substratum extends to a depth of more than 60 inches. It is friable and calcareous. The upper part is very dark gray silty clay loam. The next part is very dark gray, mottled silty clay loam that has thin strata of grayish brown very fine sand and silt loam. The lower part is stratified grayish brown and very dark gray, mottled silty clay loam. In some areas the soil contains less clay. In other areas it contains more sand.

Included with this soil in mapping are small areas of water and small areas where the soil is not calcareous. Included areas make up 10 to 15 percent of the unit.

Water and air move through the Moundprairie soil at a moderate rate. Surface runoff is slow to ponded. The seasonal high water table is 1 foot above the surface to 3 feet below during most of the year. Available water capacity is high. Organic matter content is moderate. The shrink-swell potential also is moderate, and the potential for frost action is high.

In most areas this soil is used for wildlife habitat. It is well suited to habitat for wetland wildlife. It is moderately suited to woodland. It generally is unsuited to cultivated crops, to pasture and hay, to dwellings, and to septic tank absorption fields because of the flooding and the wetness.

In areas where this soil is used as woodland, the seasonal high water table limits the use of equipment and plant competition, seedling mortality, and windthrow are management concerns. The use of equipment is limited to periods when the soil is firm and dry. The undesirable vegetation in openings where timber has been harvested can be controlled by chemical or mechanical means. The seedling mortality rate can be reduced by selecting planting stock that is larger than is typical or by mulching. Some replanting may be needed. Harvesting methods that do not isolate the remaining trees or leave them widely spaced reduce the windthrow hazard. Only high-value trees should be removed from a strip 50 feet wide along the west and south edges of the woodland. Excluding livestock from the woodland helps to prevent destruction of the leaf mulch and of desirable young trees, compaction of the soil, and damage to tree roots. Measures that protect the woodland from fire are needed.

In areas used as wetland wildlife habitat, the naturally occurring plant species furnish good food and cover for waterfowl and many other wildlife species. Measures that protect the habitat from fire and from grazing by livestock are essential. Constructing irregularly shaped areas of open water 2 to 4 feet deep can improve the habitat. About two-thirds of the area should remain vegetated with wetland plants. Erosion control in the adjacent areas minimizes sedimentation on the wetlands.

The land capability classification is Vw.

3480—Moundprairie silty clay loam, frequently flooded. This nearly level, poorly drained soil is on flood plains. It is frequently flooded for brief periods from March through June (fig. 8). Individual areas are irregular in shape and range from 20 to 1,000 acres in size.

Typically, the surface layer is mixed very dark gray and very dark grayish brown, friable, calcareous silty clay loam about 9 inches thick. The substratum extends to a buried soil at a depth of about 39 inches. It is mottled, friable, and calcareous. It is dominantly very dark gray silty clay loam, but the upper part has strata of very dark grayish brown sandy loam and silt loam. The buried soil to a depth of 60 inches or more is black, mottled, calcareous silty clay loam. In some areas the soil contains less clay. In other areas it contains more sand.

Included with this soil in mapping are small areas of the poorly drained Sawmill and well drained Terril soils. Sawmill soils are not calcareous. They are in landscape positions similar to those of the Moundprairie soil. Terril soils are on foot slopes. Included soils make up 5 to 10 percent of the unit.

Water and air move through the Moundprairie soil at a moderate rate. Surface runoff is slow to ponded. The seasonal high water table is 1 foot above the surface to 3 feet below during spring. Available water capacity is high. Organic matter content is moderate. The shrink-swell potential also is moderate, and the potential for frost action is high.

In most areas this soil is cultivated. It is moderately suited to cultivated crops. It generally is unsuited to dwellings and septic tank absorption fields because of the flooding and the wetness.

Figure 8.—Flooding in an area of Moundprairie silty clay loam, frequently flooded.

In areas where this soil is used for cultivated crops, the flooding delays planting in some years and measures that lower the seasonal high water table are needed. Dikes and levees reduce the extent of flooding. Measures that maintain or improve the drainage system are needed. Subsurface drains function satisfactorily if suitable outlets are available. Ditches also help remove excess water. A high content of lime is a limitation. It decreases the availability of phosphorus and potassium. Applying phosphorus and potassium helps to overcome this limitation. Keeping tillage at a minimum and incorporating crop residue into the surface layer minimize crusting and help to maintain tilth and fertility.

The land capability classification is IIIw.

7081—Littleton silt loam, rarely flooded. This nearly level, somewhat poorly drained soil is on alluvial fans and stream terraces. It is subject to rare flooding. Individual areas are irregular in shape and range from 3 to 100 acres in size.

Typically, the surface layer is black, friable silt loam about 7 inches thick. The subsurface layer is friable and is about 19 inches thick. The upper part is black silt loam, and the lower part is very dark gray silty clay loam. The subsoil to a depth of 60 inches or more is grayish brown, mottled, firm silty clay loam. In places the surface soil is thinner. In some areas the subsoil contains more clay. In other areas it contains more sand.

Included with this soil in mapping are small areas of the well drained Worthen soils. These soils are in gently sloping areas above the Littleton soil. They make up 2 to 5 percent of the unit.

Water and air move through the Littleton soil at a moderate rate. Surface runoff is slow. The seasonal high water table is 1 to 3 feet below the surface during

spring. Available water capacity is high. Organic matter content is moderate. The shrink-swell potential also is moderate, and the potential for frost action is high.

In most areas this soil is cultivated. It is well suited to cultivated crops. It is poorly suited to septic tank absorption fields. It generally is unsuited to dwellings because of the flooding and the wetness.

In areas where this soil is used for cultivated crops, measures that lower the seasonal high water table are needed. Subsurface tile drains function satisfactorily if suitable outlets are available. Ditches also help remove excess water. A conservation tillage system that leaves crop residue on the surface after planting helps to maintain tilth and fertility.

The seasonal high water table is a limitation on sites for septic tank absorption fields. Installing curtain drains and mounding or raising the absorption field with suitable fill material help to overcome the seasonal high water table.

The land capability classification is I.

7107—Sawmill silty clay loam, rarely flooded. This nearly level, poorly drained soil is on flood plains that are protected by levees. It is subject to rare flooding. Individual areas are long and irregular in shape and range from 5 to 250 acres in size.

Typically, the surface layer is black, firm silty clay loam about 8 inches thick. The subsurface layer is black, mottled, firm silty clay loam about 15 inches thick. The subsoil is mottled silty clay loam about 20 inches thick. The upper part is very dark gray and firm. The lower part is dark gray and friable. The substratum to a depth of 60 inches or more is dark gray, mottled, friable silty clay loam. In some areas depth to the seasonal high water table is more than 2 feet. In other areas the surface layer and the substratum contain more clay. In places the surface layer contains less clay.

Included with this soil in mapping are small areas of the poorly drained Moundprairie soils. These soils have free carbonates throughout the profile. They are in landscape positions similar to those of the Sawmill soil. They make up 5 to 10 percent of the unit.

Water and air move through the Sawmill soil at a moderate rate. Surface runoff is slow. The seasonal high water table is within a depth of 2 feet during spring. Available water capacity is very high. Organic matter content is high. The shrink-swell potential is moderate, and the potential for frost action is high.

In most areas this soil is cultivated. It is well suited to cultivated crops. It generally is unsuited to dwellings because of the wetness and the flooding. It generally is unsuited to septic tank absorption fields because of the wetness.

In areas where this soil is used for cultivated crops, the seasonal high water table is a limitation. Measures that maintain or improve the drainage system are needed. Subsurface drains function satisfactorily if suitable outlets are available. Ditches also help remove excess water. Keeping tillage at a minimum and incorporating crop residue into the surface layer minimize crusting and help to maintain tilth and fertility.

The land capability classification is IIw.

7302—Ambraw silty clay loam, rarely flooded. This nearly level, poorly drained soil is on flood plains that are protected by levees. It is subject to rare flooding. Individual areas are irregular in shape and range from 5 to 100 acres in size.

Typically, the surface layer is very dark gray, friable silty clay loam about 8 inches thick. The subsurface layer is very dark gray, mottled, friable silty clay loam about 8 inches thick. The subsoil extends to a depth of more than 60 inches. It is mottled. The upper part is dark gray, firm clay loam. The next part is grayish brown, firm sandy clay loam. The lower part is light brownish gray, friable, stratified sandy loam and sandy clay loam. In some areas the subsoil contains more clay. In other areas it contains less sand.

Included with this soil in mapping are small areas of the poorly drained Moundprairie soils. These soils are calcareous. They are in frequently flooded areas on the flood plains. They make up 2 to 10 percent of the unit.

Water and air move through the Ambraw soil at a moderately slow rate. Surface runoff is slow. The seasonal high water table is within a depth of 2 feet during spring. Available water capacity is high. Organic matter content is moderate. The shrink-swell potential also is moderate, and the potential for frost action is high.

In most areas this soil is cultivated. It is well suited to cultivated crops. It generally is unsuited to dwellings because of the wetness and the flooding. It generally is unsuited to septic tank absorption fields because of the wetness and the moderately slow permeability.

In areas where this soil is used for cultivated crops, the seasonal high water table is a limitation. Measures that maintain or improve the drainage system are needed. Subsurface drains function satisfactorily if suitable outlets are available. Ditches also help remove excess water. Keeping tillage at a minimum and incorporating crop residue into the surface layer help to minimize crusting and maintain tilth and fertility.

The land capability classification is IIw.

8077—Huntsville silt loam, occasionally flooded. This nearly level, moderately well drained soil is on flood plains. It is occasionally flooded for very brief

periods from March through June. Individual areas are irregular in shape and range from 2 to 700 acres in size.

Typically, the surface soil is friable silt loam about 38 inches thick. The upper part is black, and the lower part is very dark grayish brown. The substratum to a depth of 60 inches or more is dark brown, friable silt loam. In some areas the surface soil is lighter in color. In other areas the soil contains more sand throughout. In places the substratum is calcareous sand.

Included with this soil in mapping are small areas of the poorly drained Moundprairie soils. These soils are calcareous. They are slightly lower on the landscape than the Huntsville soil. They make up 2 to 10 percent of the unit.

Water and air move through the Huntsville soil at a moderate rate. Surface runoff is slow. The seasonal high water table is 4 to 6 feet below the surface during spring. Available water capacity is very high. Organic matter content is moderate. The shrink-swell potential is also moderate, and the potential for frost action is high.

In most areas this soil is used for cultivated crops, pasture, or hay. It is well suited to cultivated crops and to pasture and hay. It generally is unsuited to dwellings and septic tank absorption fields because of the flooding.

In areas where this soil is used for cultivated crops, the flooding delays planting in some years. Dikes or levees reduce the extent of flooding. Keeping tillage at a minimum and incorporating crop residue into the surface layer minimize crusting and maintain tilth and fertility.

The land capability classification is IIw.

8107—Sawmill silty clay loam, occasionally flooded. This nearly level, poorly drained soil is on flood plains. It is occasionally flooded for brief periods from March through June. Individual areas are long and narrow or irregular in shape and range from 5 to 300 acres in size.

Typically, the surface layer is black, friable silty clay loam about 9 inches thick. The subsurface layer is friable silty clay loam about 24 inches thick. The upper part is black, and the lower part is very dark gray. The subsoil is dark gray, mottled, friable silty clay loam about 21 inches thick. The substratum to a depth of 60 inches or more is dark grayish brown, mottled, friable silty clay loam. In some areas the surface layer and the subsurface layer are stratified and contain more sand. In other areas sand and gravel are at the surface. In places the surface soil is thinner and contains less clay.

Included with this soil in mapping are small areas of somewhat poorly drained and moderately well drained soils in the higher landscape positions that are not subject to flooding. These soils make up about 2 to 10 percent of the unit.

Water and air move through the Sawmill soil at a moderate rate. Surface runoff is slow. The seasonal high water table is within a depth of 2 feet during spring. Available water capacity is very high. Organic matter content is high. The shrink-swell potential is moderate, and the potential for frost action is high.

In most areas this soil is cultivated. It is well suited to cultivated crops. It generally is unsuited to dwellings and septic tank absorption fields because of the wetness and the flooding.

In areas where this soil is used for cultivated crops, the flooding delays planting in some years and measures that lower the seasonal high water table are needed. Dikes or levees reduce the extent of flooding. Measures that improve or maintain the drainage system are needed. Subsurface drains function satisfactorily if suitable outlets are available. Ditches also help remove excess water. Keeping tillage at a minimum and incorporating crop residue into the surface layer help to minimize crusting and maintain tilth and fertility.

The land capability classification is IIw.

8304—Landes fine sandy loam, occasionally flooded. This nearly level, well drained soil is on flood plains. It is occasionally flooded for brief periods from March through June. Individual areas are elongated and range from 15 to 150 acres in size.

Typically, the surface layer is very dark gray, friable fine sandy loam about 9 inches thick. The subsurface layer is very dark grayish brown, friable loam about 3 inches thick. The subsoil is about 26 inches thick. It is friable. The upper part is very dark grayish brown loam. The lower part is brown fine sandy loam. The substratum to a depth of 60 inches or more is brown, very friable sandy loam. In some areas the surface layer is lighter in color. In other areas the subsoil contains more sand and gravel. A few areas have a thicker dark surface soil.

Included with this soil in mapping are small areas of the poorly drained Moundprairie and Sawmill soils and the well drained Martinsville soils. Moundprairie and Sawmill soils are slightly lower on the landscape than the Landes soil. Also, they have more clay throughout. Martinsville soils contain more clay in the subsoil than the Landes soil. They are in the slightly higher areas on terraces that are not subject to flooding. Also included are somewhat poorly drained soils with stratified, sandy and loamy textures in areas where streams have deposited sediments carried by floodwater. Included soils make up 10 to 15 percent of the unit.

Water and air move through the Landes soil at a moderately rapid rate. Surface runoff is slow. Available

water capacity is moderate. Organic matter content is moderately low. The shrink-swell potential is low, and the potential for frost action is moderate.

In most areas this soil is cultivated. In some areas it is used for pasture and hay. It is well suited to cultivated crops and to pasture and hay. It generally is unsuited to dwellings because of the flooding and to septic tank absorption fields because of the flooding and a poor filtering capacity.

In areas where this soil is used for cultivated crops, the flooding delays planting in some years, the moderate available water capacity is a limitation, and measures that control soil blowing are needed. Dikes or levees reduce the extent of flooding. A conservation tillage system that leaves crop residue on the surface after planting helps to control soil blowing and conserves soil moisture. Winter cover crops and field windbreaks also help to control soil blowing. Irrigation systems may be needed because of the moderate available water capacity.

In areas used for pasture and hay, flooding is a hazard, the moderate available water capacity is a limitation, and measures that control soil blowing are needed. Dikes or levees reduce the extent of flooding. Selection of suitable species for planting, rotation grazing, deferred grazing, and applications of fertilizer help to keep the pasture in good condition and help to control soil blowing. Irrigation systems may be needed because of the moderate available water capacity. Orchardgrass, bromegrass, timothy, alfalfa, and red clover are suitable forage species.

The land capability classification is IIw.

8378—Lanier gravelly sandy loam, occasionally flooded. This nearly level, well drained soil is on flood plains. It is occasionally flooded for brief periods from March through June. It occurs as one area, which is irregular in shape and is 180 acres in size.

Typically, the surface layer is black, friable gravelly sandy loam about 7 inches thick. The subsurface layer is very dark grayish brown, very friable, calcareous extremely gravelly loamy coarse sand about 4 inches thick. The substratum extends to a depth of more than 60 inches. The upper part is brown, loose, calcareous extremely gravelly coarse sand that has strata of gravelly sandy loam. The lower part is brown, loose, calcareous very gravelly coarse sand. In some areas the soil contains more silt and clay and less sand and gravel throughout. In other areas the surface soil is thicker.

Included with this soil in mapping are small areas of the poorly drained Moundprairie, excessively drained Rodman, and well drained Wea soils. Moundprairie soils contain more silt and clay and less sand and gravel than the Lanier soil. They are in the slightly lower areas. Rodman soils are in the more sloping areas on stream terraces above the Lanier soil. Wea soils contain more silt and clay and less sand and gravel in the upper part of the profile than the Lanier soil. They are in nearly level areas on stream terraces above the Lanier soil. Included soils make up 2 to 10 percent of the unit.

Water and air move through the Lanier soil at a very rapid rate. Surface runoff is slow. Available water capacity is low. Organic matter content is moderate. The shrink-swell potential and the potential for frost action are low.

In most areas this soil is used for cultivated crops, pasture, or hay. It is well suited to cultivated crops and to pasture and hay. It generally is unsuited to dwellings because of the flooding and to septic tank absorption fields because of the flooding and a poor filtering capacity.

In areas where this soil is used for cultivated crops, the flooding delays planting in some years, the low available water capacity is a limitation, and measures that control soil blowing are needed. Dikes or levees reduce the extent of flooding. A conservation tillage system that leaves crop residue on the surface after planting helps to control soil blowing and conserves soil moisture. Winter cover crops and field windbreaks also help to control soil blowing. Irrigation systems may be needed because of the low available water capacity.

In areas used for pasture and hay, flooding is a hazard, the low available water capacity is a limitation, and measures that control soil blowing are needed. Dikes or levees reduce the extent of flooding. Seeding, rotation grazing, deferred grazing, and applications of fertilizer help to keep the pasture in good condition and help to control soil blowing. Irrigation systems may be needed because of the low available water capacity. Orchardgrass, bromegrass, timothy, alfalfa, and red clover are suitable forage species.

The land capability classification is IIw.

Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high-quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food,

Figure 9.—Prime farmland in an area of Huntsville silt loam, occasionally flooded, on a flood plain.

feed, forage, fiber, and oilseed crops. It may be cultivated land, pasture, woodland, or other land, but it is not urban or built-up land or water areas. It either is used for food or fiber crops or is available for those crops. The soil qualities, growing season, and moisture supply are those needed for a well managed soil to produce a sustained high yield of crops in an economic manner. Prime farmland produces the highest yields with minimal expenditure of energy and economic resources, and farming it results in the least damage to the environment.

Prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season (fig. 9). The slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Soil Conservation Service.

A recent trend in land use in some parts of the county has been the loss of some prime farmland to industrial and urban uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, droughty, and less productive and cannot be easily cultivated.

The map units in Putnam County that are considered prime farmland are listed in table 5. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use and management are described under the heading "Detailed Soil Map Units."

Some soils that have a seasonal high water table and all soils that are frequently flooded during the growing season qualify for prime farmland only in areas where these limitations have been overcome by such drainage measures or flood control. The need for these measures is indicated after the map unit name in table 5. Onsite evaluation is needed to determine whether or not these limitations have been overcome by corrective measures. In Putnam County most of the naturally wet soils have been adequately drained.

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavioral characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and Pasture

Thomas A. Benjamin, district conservationist, Soil Conservation Service, helped prepare this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

The primary crops in Putnam County are corn and soybeans. In 1982, corn was produced on about 41,434 acres and soybeans on about 21,296 acres. About 1,854 acres was used for pasture, and about 2,001 acres was used for hay. The acreage of cropland has increased slightly over the past ten years *(9)*.

The potential of the soils in Putnam County for increased crop production is good if the soils are managed properly. Food production could be increased by extending the latest crop production technology to all of the cropland in the county. This soil survey can greatly facilitate the application of such technology. The following paragraphs describe the major management concerns in the areas of cropland and pasture in the county.

Water erosion is the major management concern on about 45 percent of the pasture and cropland in the county. It is a hazard if the slope is more than 2 percent. The hazard is more severe on soils that have steep, long slopes.

Loss of the surface layer through water erosion is damaging for three reasons. First, productivity and the natural fertility level are reduced as the surface layer is lost and part of the subsoil is incorporated into the plow layer. The surface layer contains most of the chemically active organic matter in the soil. The second reason that loss of the surface layer is damaging is that it results in poor tilth in the surface soil and reduces the rate of water infiltration. Surface soils that are mixed with the subsoil material tend to be cloddy when tilled. Preparing a good seedbed is difficult on these soils. These soils crust after hard rains. As a result, the runoff

rate is faster. The third reason that loss of the surface layer is damaging is that it results in the sedimentation of streams, rivers, ponds, and road ditches. Control of water erosion minimizes this pollution and improves the quality of water available for municipal use, for recreation, and for fish and wildlife.

A good management system maintains or improves natural fertility, controls water erosion and soil blowing, removes excess water, and maintains good tilth. Adequate vegetative cover and mechanical practices that reduce slope length help to control water erosion and soil blowing. These measures also reduce the runoff rate and increase the rate of water infiltration. A cropping system that keeps plant cover and crop residue on the surface during critical rainfall periods in the spring helps to control erosion and maintain soil productivity. A crop rotation that includes grasses and legumes provides nitrogen to the crop and improves tilth for the following crop.

A conservation tillage system, such as chisel plowing, no-till, and ridge-till planting, helps to control erosion, reduces the runoff rate, and increases the rate of water infiltration. A no-till system, for example, can reduce erosion rates by as much as 90 percent compared to the conventional system of using a moldboard plow in the fall.

Contour farming, contour stripcropping, terraces, and diversions help to control erosion and reduce the runoff rate. These methods are most effective on soils that have uniform and regular slopes, such as Tama and Catlin soils. Erosion control is more difficult on soils that have short and irregular slopes, such as Varna and Miami soils. In areas of these soils, using a crop rotation and a conservation tillage system that leaves crop residue on the surface after planting helps to control erosion.

Grassed waterways help to carry excess surface water safely downslope to the nearest creek, stream, or other watercourse. They are most effective in areas of soils that have slopes of 2 percent or more. When established in natural drainageways, they convey the water at a nonerosive velocity. Grassed waterways generally are installed in conjunction with other conservation practices, such as terraces, diversions, conservation tillage systems, and contour farming. These practices conserve soil moisture and reduce soil loss on cropland and in other areas.

Crop rotations that include forage crops help to control erosion in areas of soils that are sloping to steep, such as Miami, Fayette, and Varna soils. These rotations also help to maintain the content of organic matter, improve tilth, and reduce the negative effects of weeds and insects.

Soil blowing is a hazard on about 10 percent of the cropland in the county. Examples of sandy soils that are susceptible to soil blowing include Ade, Alvin, and Bloomfield soils. Planting field windbreaks, using a conservation tillage system that leaves crop residue on the surface after planting, and maintaining a plant cover help to control soil blowing. In areas where these soils are used for row crops, conservation tillage systems are effective in controlling erosion. Information about the erosion-control measures suitable for specific soils is available in local offices of the Soil Conservation Service.

Poorly drained and somewhat poorly drained soils that are used for crops benefit from artificial drainage. Drainage systems have been installed in most areas of these soils. Additional drainage systems are needed to improve crop production in some areas that have been previously drained. Drummer, Harpster, and Sable soils are poorly drained, and Muscatine and Flanagan soils are somewhat poorly drained.

The design of surface and subsurface drainage systems varies with the kind of soil. Tile drains alone are inadequate to control surface ponding on many soils. A combination of surface ditches and tile is needed in some areas of poorly drained soils, such as Drummer, Harpster, and Sable soils. The seasonal high water table in moderately permeable and moderately slowly permeable soils, such as Flanagan and Drummer soils, can be adequately drained by tile if suitable outlets are available. Tile drains are not effective in slowly permeable soils, such as Blount soils. Surface drains and surface inlets may be needed to provide adequate control of the seasonal high water table in areas of these soils. Information about drainage systems is available in local offices of the Soil Conservation Service.

The soils in the county that have a moderate, low, or very low available water capacity are droughty. The physical composition of these soils limits the amount of water that is available for optimum plant growth. Ade and Dakota soils are examples. The effects of droughtiness can be minimized by increasing the rate of water infiltration, reducing the runoff rate, reducing plant populations, and planting crops that are drought tolerant. No-till farming and crop residue management increase the rate of water infiltration and reduce the runoff rate and the rate of evaporation of surface moisture. Some crops, such as grain sorghum, are more tolerant of a limited water supply than corn. Also, winter wheat is better suited than corn because it matures in spring before the period of normal low rainfall begins.

Soil fertility varies in the soils in Putnam County. It is low, for example, in Bloomfield and Ade soils and is very high in Sable soils. On most of the soils in the

county, crops respond well to additions of nitrogen, phosphorus, and potassium fertilizers and certain micronutrients. In areas of the more acid Fayette and Tama soils, applications of ground limestone help to raise the pH level sufficiently for good crop production. On the calcareous Harpster soils, lime is not needed because the pH is naturally high. The kinds and amounts of lime and fertilizer to be applied should be based on the results of soil tests.

Soil tilth is a management concern on many of the soils in the county. It affects seed germination, the amount of surface runoff, and the rate of water infiltration. Tilth is good in soils that are granular and porous. Most of the soils in the county that are used for crops have a loam, silt loam, or silty clay loam surface layer. Some of the soils, such as Fayette and Miami soils, have a lower content of organic matter and will develop a crust on the surface after periods of intensive rainfall. The crust is hard when dry and is nearly impervious to water. It decreases the infiltration rate, increases surface runoff, and affects germination and seedling emergence. Regular additions of crop residue, manure, and organic material improve soil structure and reduce the likelihood of crusting.

In areas of poorly drained soils, such as Drummer, Sable, and Harpster soils, clods form if the soils are tilled when wet. As a result, preparing a good seedbed is difficult. Primary tillage commonly is delayed because these soils often stay wet until late in spring. Proper drainage ensures timeliness of tillage and promotes warming of the soil to the temperature needed for good germination. If the soils are tilled in the fall, leaving crop residue on the surface helps to control soil blowing.

The main field crops grown in the county are corn and soybeans. Small grain and forage crops also are grown. Forage crops could be grown more extensively on nearly all of the cropland for effective erosion control. The latest information about crops can be obtained from local offices of the Soil Conservation Service and the Cooperative Extension Service.

In the areas used for pasture, measures that help to control erosion, improve fertility, and prevent overgrazing are needed. Applications of lime and fertilizer should be based on the results of soil tests. Yearly applications of fertilizer help to keep the pasture productive and maintain a dense stand of grasses and legumes.

Pastures should not be grazed when the soils are wet. Rotation grazing, proper stocking rates, and deferred grazing help to keep the stand productive. Seeding and maintaining legumes, such as alfalfa and red clover, in the stand of grasses improve the quality and productivity of the pasture and hayland and provide nitrogen for the grasses. Grasses commonly grown include orchardgrass, bromegrass, and timothy.

Yields Per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification of each map unit also is shown in the table.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents *(3)*. Available yield data from nearby counties and results of field trials and demonstrations also are considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

The majority of the soils used for crops in Putnam County are not irrigated. The yields listed in table 6 show the average yields per acre that can be expected for nonirrigated conditions. If a soil is irrigated with good quality water and proper management practices are applied, the average crop yields could be higher than those listed in table 6.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops *(7)*. Crops that require special management are excluded. The soils are grouped according to their

limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main hazard is the risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c,* used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V contains only the subclasses indicated by *w, s,* or *c* because the soils in class V are subject to little or no erosion. They have other limitations that restrict their use to pasture, woodland, wildlife habitat, or recreation.

The acreage of soils in each capability class and subclass is shown in table 7. The capability classification of each map unit is given in the section "Detailed Soil Map Units" and in the yields table.

Woodland Management and Productivity

Only 25 percent of Putnam County was originally covered by hardwood forests. In 1982, about 10,154 acres, or less than 10 percent of the county, was used for woodland. Most of the woodland is on the narrow bluffs along the Illinois River and on the adjacent flood plains. The wooded areas are in associations 1, 3, 6, 7, and 8, which are described in the section "General Soil Map Units." Very little of the woodland is managed for timber.

Measures that improve timber stands and protect the stands from grazing by livestock increase productivity of the woodland. Planting recommended species in harvested areas also improves productivity.

Table 8 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for an indicator tree species. The number indicates the volume, in cubic meters per hectare per year, which the indicator species can produce. The number 1 indicates low potential productivity; 2 and 3, moderate; 4 and 5, moderately high; 6 to 8, high; 9 to 11, very high; and 12 to 39, extremely high. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *R* indicates steep slopes; *X*, stoniness or rockiness; *W*, excess water in or on the soil; *T*, toxic substances in the soil; *D*, restricted rooting depth; *C*, clay in the upper part of the soil; *S*, sandy texture; and *F*, a high content of rock fragments in the soil. The letter *A* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: R, X, W, T, D, C, S, and F.

In table 8, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Erosion hazard is the probability that damage will occur as a result of site preparation and cutting where the soil is exposed along roads, skid trails, fire lanes, and log-handling areas. Forests that have been burned or overgrazed are also subject to erosion. Ratings of

the erosion hazard are based on the percent of the slope. A rating of *slight* indicates that no particular prevention measures are needed under ordinary conditions. A rating of *moderate* indicates that erosion-control measures are needed in certain silvicultural activities. A rating of *severe* indicates that special precautions are needed to control erosion in most silvicultural activities.

Equipment limitation reflects the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. The chief characteristics and conditions considered in the ratings are slope, stones on the surface, rock outcrops, soil wetness, and texture of the surface layer. A rating of *slight* indicates that under normal conditions the kind of equipment or season of use is not significantly restricted by soil factors. Soil wetness can restrict equipment use, but the wet period does not exceed 1 month. A rating of *moderate* indicates that equipment use is moderately restricted because of one or more soil factors. If the soil is wet, the wetness restricts equipment use for a period of 1 to 3 months. A rating of *severe* indicates that equipment use is severely restricted either as to the kind of equipment that can be used or the season of use. If the soil is wet, the wetness restricts equipment use for more than 3 months.

Seedling mortality refers to the death of naturally occurring or planted tree seedlings, as influenced by the kinds of soil, soil wetness, or topographic conditions. The factors used in rating the soils for seedling mortality are texture of the surface layer, depth to a seasonal high water table and the length of the period when the water table is high, rock fragments in the surface layer, effective rooting depth, and slope aspect. A rating of *slight* indicates that seedling mortality is not likely to be a problem under normal conditions. Expected mortality is less than 25 percent. A rating of *moderate* indicates that some problems from seedling mortality can be expected. Extra precautions are advisable. Expected mortality is 25 to 50 percent. A rating of *severe* indicates that seedling mortality is a serious problem. Extra precautions are important. Replanting may be necessary. Expected mortality is more than 50 percent.

Windthrow hazard is the likelihood that trees will be uprooted by the wind because the soil is not deep enough for adequate root anchorage. The main restrictions that affect rooting are a seasonal high water table and the depth to bedrock, a fragipan, or other limiting layers. A rating of *slight* indicates that under normal conditions no trees are blown down by the wind. Strong winds may damage trees, but they do not uproot them. A rating of *moderate* indicates that some trees can be blown down during periods when the soil is wet and winds are moderate or strong. A rating of *severe* indicates that many trees can be blown down during these periods.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index* and as a *productivity class*. The site index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

The *productivity class*, a number, is the yield likely to be produced by the most important trees. This number, expressed as cubic meters per hectare per year, indicates the amount of fiber produced in a fully stocked, even-aged, unmanaged stand.

The first species listed under *common trees* for a soil is the indicator species for that soil. It is the dominant species on the soil and the one that determines the ordination class.

Trees to plant are those that are suitable for commercial wood production.

Windbreaks and Environmental Plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, help to keep snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To ensure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 9 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 9 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs

can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a commercial nursery.

Recreation

There are many recreational and scenic areas in Putnam County. These areas are used for hunting, fishing, hiking, camping, and picnicking, as nature sites, and for other forms of recreation. Public recreation areas include the Miller Anderson and George Park Nature Preserves; the Fox Run, Lake Senachwine, and Putnam County Conservation Areas; the Hennepin Park District Recreation Center; and the Illinois River. The county also has several private recreation facilities.

The soils of the survey area are rated in table 10 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 10, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 10 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 13 and interpretations for dwellings without basements and for local roads and streets in table 12.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

The soils of Putnam County support habitat for a variety of wildlife. Major wildlife species in openland and woodland areas are deer, pheasant, rabbit, squirrel, raccoon, mourning dove, quail, and songbirds. Waterfowl and shore birds, such as ducks, geese, herons, cranes, and swans, inhabit the wetland areas.

Surface waters in Putnam County provide good habitat for several species of fish. Many species of gamefish, panfish, and rough fish are in the Illinois River and its tributaries and, depending on stocking practices, in lakes and ponds.

Wet or ponded areas provide good habitat for wetland wildlife. The food value of natural wetland plants commonly is rated higher than that of agricultural crops for waterfowl and many other wildlife species. The habitat for several species of shore birds and waterfowl can be improved by establishing grassy

nesting cover on the adjacent uplands. Livestock should be excluded from the wetlands and the areas of nesting cover. Controlling erosion on adjacent land helps to keep sediment from filling in the wetlands and destroying the plant communities.

The quality of woodland wildlife habitat depends on the quality of the woodland plant community. The habitat can support the greatest diversity of woodland wildlife species if it is managed for a wide diversity of tree and shrub species. Maximum protection of wildlife can be achieved by establishing a shrub or brushy edge around the woodland. Dead trees or snags should be left standing because they provide habitat for cavity-nesting species and provide perching and feeding sites. Fallen logs and brush piles provide valuable cover for prey species. The woodland should be protected from fire and from grazing by livestock.

Good management can improve the habitat for openland wildlife. Keeping crop residue on the surface during fall and winter not only helps to control erosion but also greatly improves wildlife habitat in cropped areas. Deferred mowing of grassed waterways, roadsides, and fence rows until early August, after the nesting season, can significantly increase populations of wildlife species that nest on the ground.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 11, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and sunflowers.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are orchardgrass, bluegrass, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, wheatgrass, and ragweed.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are oak, poplar, cherry, sweetgum, apple, hawthorn, dogwood, hickory, blackberry, and blueberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are Russian olive, autumn olive, and crabapple.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, pondweed, cattail, cordgrass, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are

created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. Wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include warblers, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, and chipmunks.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, mink, and beaver.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations should be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kinds of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to evaluate the potential of areas for residential, commercial, industrial, and recreation uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the "Glossary."

Building Site Development

Table 12 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant

increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and depth to the water table.

Dwellings and *small commercial buildings* are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material; a base of gravel, crushed rock, or stabilized soil material; and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic-supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 13 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 13 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly

level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 13 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage resulting from rapid permeability in the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground-water pollution. Ease of excavation and revegetation should be considered.

The ratings in table 13 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed. The ratings in table 13 are for area type landfills only because the ratings for the trench type are not valid in the survey area.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 14 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help to determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand

or gravel or both. They have at least 5 feet of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and depth to the water table is less than 1 foot. These soils may have layers of suitable material, but the material is less than 3 feet thick.

Sand and *gravel* are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 14, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 15 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and for embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a

depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to control erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of soil blowing or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classification, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 16 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the "Glossary."

Classification of the soils is determined according to the Unified soil classification system *(2)* and the system adopted by the American Association of State Highway and Transportation Officials *(1)*.

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The

sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 17 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at ⅓ bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six

factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to soil blowing in cultivated areas. The groups indicate the susceptibility to soil blowing. Soils are grouped according to the following distinctions:

1. Coarse sands, sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy coarse sands, loamy sands, loamy fine sands, loamy very fine sands, and sapric soil material. These soils are very highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

3. Coarse sandy loams, sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loams, silt loams, clay loams, and silty clay loams. These soils are erodible. Crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control soil blowing are used.

5. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material. These soils are slightly erodible. Crops can be grown if measures to control soil blowing are used.

6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay. These soils are very slightly erodible. Crops can be grown if ordinary measures to control soil blowing are used.

7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material. These soils are very slightly erodible. Crops can be grown if ordinary measures to control soil blowing are used.

8. Soils that are not subject to soil blowing because of coarse fragments on the surface or because of surface wetness.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 17, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 18 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the infiltration of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to two hydrologic groups in table 18, the first letter is for drained areas and the second is for undrained areas.

Flooding, the temporary inundation of an area, is

caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 18 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs, on the average, once or less in 2 years; and *frequent* that it occurs, on the average, more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 18 are the depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 18.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(8)*. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 19 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Eleven soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Mollisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquoll (*Aqu*, meaning water, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Haplaquolls (*Hapl*, meaning minimal horizonation, plus *aquolls*, the suborder of the Mollisols that has an aquic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Haplaquolls.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-silty, mixed, mesic Typic Haplaquolls.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the "Soil Survey Manual" *(6)*. Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" *(8)*. Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Ade Series

The Ade series consists of somewhat excessively drained, rapidly permeable soils on dunes. These soils formed in sandy eolian material. Slopes range from 1 to 15 percent.

Typical pedon of Ade loamy fine sand, 7 to 15 percent slopes, 2,310 feet west and 2,070 feet north of the southeast corner of sec. 2, T. 31 N., R. 2 W.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) loamy fine sand, grayish brown (10YR 5/2) dry; weak medium granular structure; very friable; few medium roots; medium acid; abrupt smooth boundary.

A—10 to 17 inches; dark brown (10YR 3/3) fine sand, brown (10YR 5/3) dry; weak medium granular structure; very friable; few medium roots; neutral; clear smooth boundary.

Bw—17 to 24 inches; brown (10YR 4/3) fine sand; weak medium subangular blocky structure; very friable; few medium roots; common distinct dark brown (10YR 3/3) organic coatings on faces of peds; neutral; clear smooth boundary.

E&Bt—24 to 60 inches; yellowish brown (10YR 5/4) fine sand (E); dark brown (7.5YR 4/4) lamellae of sandy loam and loamy sand (Bt) 1 to 3 inches thick; single grain; loose; neutral.

The mollic epipedon ranges from 13 to 22 inches in thickness. The Bw horizon has value of 4 or 5 and chroma of 3 or 4. It is fine sand or loamy fine sand. The E part of the E&Bt horizon has value of 4 or 5 and chroma of 4 to 6. The Bt lamellae have hue of 7.5YR or 10YR and chroma of 4 to 6.

Alvin Series

The Alvin series consists of well drained, moderately permeable soils on stream terraces. These soils formed in stream alluvium. Slopes range from 2 to 30 percent.

Typical pedon of Alvin fine sandy loam, 7 to 20 percent slopes, 510 feet west and 1,520 feet north of the southeast corner of sec. 1, T. 32 N., R. 2 W.

Ap—0 to 4 inches; very dark grayish brown (10YR 3/2) fine sandy loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; common very fine and fine roots; medium acid; clear smooth boundary.

E—4 to 8 inches; brown (10YR 4/3) fine sandy loam; weak medium platy structure; friable; common very fine and fine roots; common distinct very dark grayish brown (10YR 3/2) stains between plates; medium acid; clear smooth boundary.

Bt1—8 to 14 inches; dark yellowish brown (10YR 4/6) fine sandy loam; weak medium platy structure parting to weak fine subangular blocky; friable; common very fine and fine roots; many faint dark yellowish brown (10YR 4/4) clay films on faces of peds; medium acid; clear smooth boundary.

Bt2—14 to 22 inches; dark yellowish brown (10YR 4/6) sandy loam; moderate medium subangular and angular blocky structure; friable; few very fine and fine roots; many distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; medium acid; clear smooth boundary.

Bt3—22 to 28 inches; dark yellowish brown (10YR 4/6) sandy loam; weak medium subangular blocky structure; friable; few very fine roots; common distinct dark yellowish brown (7.5YR 4/4) clay films on faces of peds; few fine concretions of iron and manganese oxide; medium acid; clear smooth boundary.

Bt4—28 to 35 inches; strong brown (7.5YR 4/6) sandy loam; weak medium prismatic structure; friable; few very fine roots; common distinct brown (7.5YR 4/4) clay films on faces of peds; medium acid; clear smooth boundary.

BC—35 to 44 inches; strong brown (7.5YR 4/6) loamy sand that has lamellae of sandy loam; weak medium prismatic structure; loose; few very fine roots; few distinct brown (7.5YR 4/4) clay films on faces of peds; few fine concretions of iron and manganese oxide; slightly acid; gradual smooth boundary.

C—44 to 60 inches; strong brown (7.5YR 4/6) loamy sand; single grain; loose; few very fine roots; slightly acid.

The thickness of the solum ranges from 40 to more than 60 inches. The Ap horizon has value of 3 or 4 and chroma of 2 or 3. In cultivated areas the E horizon commonly is incorporated into the Ap horizon. The Bt horizon has chroma of 4 to 6. It is fine sandy loam, sandy loam, or sandy clay loam. The C horizon is sand, loamy sand, or sandy loam and is stratified in some pedons.

Ambraw Series

The Ambraw series consists of poorly drained, moderately slowly permeable soils on flood plains. These soils formed in loamy alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Ambraw silty clay loam, rarely flooded, 700 feet south and 220 feet east of the northwest corner of sec. 27, T. 32 N., R. 2 W.

Ap—0 to 8 inches; very dark gray (10YR 3/1) silty clay loam, grayish brown (10YR 5/2) dry; moderate medium granular structure; friable; few very fine

roots; medium acid; abrupt smooth boundary.

A—8 to 16 inches; very dark gray (10YR 3/1) silty clay loam, grayish brown (10YR 5/2) dry; common fine prominent strong brown (7.5YR 5/6) mottles; moderate fine angular blocky structure parting to moderate medium granular; friable; few very fine roots; slightly acid; clear smooth boundary.

Bg1—16 to 27 inches; dark gray (10YR 4/1) clay loam; common fine prominent strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; few very fine roots; slightly acid; clear smooth boundary.

Bg2—27 to 36 inches; dark gray (10YR 4/1) clay loam; many fine prominent strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; few very fine roots; medium acid; clear smooth boundary.

Bg3—36 to 46 inches; mottled grayish brown (10YR 5/2) and strong brown (7.5YR 5/6) sandy clay loam; weak coarse subangular blocky structure; firm; medium acid; clear smooth boundary.

BCg—46 to 60 inches; light brownish gray (10YR 6/2), stratified sandy loam and sandy clay loam; many fine prominent strong brown (7.5YR 5/6) mottles; massive; friable; few distinct dark gray (10YR 4/1) clay films lining root channels; neutral.

The thickness of the solum and the depth to carbonates range from 55 to more than 60 inches. The mollic epipedon ranges from 12 to 18 inches in thickness.

The Ap and A horizons have value of 2 or 3 and chroma of 1 or 2. They are loam or silty clay loam. Some pedons have a Cg horizon within a depth of 60 inches. This horizon is sandy loam, sandy clay loam, or loam and commonly is stratified.

Birkbeck Series

The Birkbeck series consists of moderately well drained, moderately permeable soils on glacial till plains and moraines. These soils formed in loess and in the underlying glacial till. Slopes range from 2 to 10 percent.

Typical pedon of Birkbeck silt loam, 2 to 5 percent slopes, 1,535 feet east and 70 feet north of the southwest corner of sec. 27, T. 33 N., R. 1 W.

Ap—0 to 7 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; few fine roots; neutral; abrupt smooth boundary.

Bt1—7 to 14 inches; yellowish brown (10YR 5/4) silty clay loam; moderate fine subangular blocky structure; friable; few fine roots; many distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; common distinct light gray (10YR 7/2 dry) silt coatings on faces of peds; slightly acid; clear smooth boundary.

Bt2—14 to 23 inches; yellowish brown (10YR 5/4) silty clay loam; common fine distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; few fine roots; many faint dark yellowish brown (10YR 4/4) clay films on faces of peds; common distinct light gray (10YR 7/2 dry) silt coatings on faces of peds; medium acid; clear smooth boundary.

Bt3—23 to 35 inches; yellowish brown (10YR 5/4) silty clay loam; common fine prominent yellowish brown (7.5YR 5/6) and common fine distinct grayish brown (10YR 5/2) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; friable; few fine roots; many faint dark yellowish brown (10YR 4/4) clay films on faces of peds; common distinct light gray (10YR 7/2 dry) silt coatings on faces of peds; few fine accumulations of iron and manganese oxide; strongly acid; clear smooth boundary.

Bt4—35 to 47 inches; yellowish brown (10YR 5/4) silty clay loam; common fine prominent yellowish brown (7.5YR 5/6) and common fine distinct grayish brown (10YR 5/2) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; friable; few fine roots; common faint dark yellowish brown (10YR 4/4) clay films on faces of peds; common medium soft accumulations of iron and manganese oxide; medium acid; clear smooth boundary.

2BC—47 to 55 inches; brown (10YR 5/3) clay loam; common coarse prominent yellowish brown (7.5YR 5/6) and common medium faint grayish brown (10YR 5/2) mottles; weak medium prismatic structure; firm; few fine roots; few distinct brown (7.5YR 4/4) clay films on faces of peds; common medium accumulations of iron and manganese oxide; medium acid; clear smooth boundary.

2C—55 to 60 inches; brown (10YR 5/3) clay loam; massive; firm; slight effervescence; mildly alkaline.

The thickness of the solum and the depth to carbonates range from 44 to more than 60 inches. The Ap horizon has value of 3 or 4 and chroma of 2 or 3. Some pedons in uncultivated areas have an E horizon. This horizon is silt loam. It has value of 4 and chroma of 2 or 3. The Bt horizon has value of 4 or 5 and chroma of 3 to 6. It is dominantly silty clay loam, but in some pedons it is silt loam in the upper part. The 2BC horizon has chroma of 3 to 6. It is silty clay loam or clay

loam. The 2C horizon has value of 5 or 6 and chroma of 3 to 6. It is loam or clay loam.

Bloomfield Series

The Bloomfield series consists of somewhat excessively drained, rapidly permeable soils on dunes. These soils formed in sandy eolian material. Slopes range from 1 to 20 percent.

Typical pedon of Bloomfield loamy fine sand, 7 to 20 percent slopes, 1,810 feet south and 805 feet east of the northwest corner of sec. 12, T. 32 N., R. 2 W.

Ap—0 to 4 inches; dark brown (10YR 3/3) loamy fine sand, brown (10YR 5/3) dry; weak fine granular structure; very friable; many very fine roots; slightly acid; clear smooth boundary.

E1—4 to 8 inches; brown (10YR 4/3) fine sand; weak medium platy structure parting to weak fine granular; very friable; common fine roots; slightly acid; clear smooth boundary.

E2—8 to 22 inches; dark yellowish brown (10YR 4/4) fine sand; single grain; loose; few very fine roots; slightly acid; clear wavy boundary.

E&Bt1—22 to 41 inches; yellowish brown (10YR 5/4) fine sand (E); single grain; loose; many dark yellowish brown (10YR 4/4) lamellae of loamy sand ⅛ to ½ inch thick (Bt); weak fine subangular blocky structure; very friable; few very fine roots; medium acid; clear wavy boundary.

E&Bt2—41 to 60 inches; yellowish brown (10YR 5/4) sand (E); single grain; loose; dark yellowish brown (10YR 4/4) lamellae of loamy fine sand 2 to 6 inches thick (Bt); weak medium subangular blocky structure; very friable; few very fine roots; medium acid.

The A or Ap horizon has value and chroma of 3 or 4. The E horizon has value of 4 or 5 and chroma of 3 or 4. The Bt lamellae are loamy fine sand, fine sandy loam, fine sand, or loamy sand.

Blount Series

The Blount series consists of somewhat poorly drained, slowly permeable soils on glacial till plains. These soils formed in loess and in the underlying glacial till. Slopes range from 1 to 5 percent.

Typical pedon of Blount silt loam, 1 to 5 percent slopes, 780 feet south and 1,120 feet west of the northeast corner of sec. 31, T. 33 N., R. 1 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; common very fine roots; few fine dark soft accumulations of iron and manganese oxide; strongly acid; clear smooth boundary.

E—7 to 10 inches; grayish brown (10YR 5/2) and yellowish brown (10YR 5/4) silt loam; few medium distinct yellowish brown (10YR 5/6) mottles; weak medium platy structure parting to moderate very fine subangular blocky; friable; common very fine roots; few distinct light brownish gray (10YR 6/2 dry) silt coatings on faces of peds; few fine soft dark accumulations of iron and manganese oxide; strongly acid; abrupt smooth boundary.

Bt1—10 to 17 inches; brown (10YR 5/3) silty clay loam; common medium distinct yellowish brown (10YR 5/6) and few fine distinct gray (10YR 5/1) mottles; moderate fine subangular blocky structure; friable; common very fine roots; few distinct light gray (10YR 7/2 dry) silt coatings on faces of peds; many distinct dark grayish brown (10YR 5/2) and few distinct dark brown (10YR 3/3) clay films on faces of peds; common fine soft dark accumulations of iron and manganese oxide; strongly acid; gradual smooth boundary.

2Bt2—17 to 26 inches; dark grayish brown (10YR 4/2) silty clay loam; common medium distinct yellowish brown (10YR 5/6) and few fine faint gray (10YR 5/1) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; friable; common very fine roots; common distinct very dark grayish brown (10YR 3/2) and dark brown (10YR 3/3) and few distinct very dark gray (10YR 3/1) clay films on faces of peds; many soft dark accumulations of iron and manganese oxide and few medium dark concretions of iron and manganese oxide; few pebbles; medium acid; clear smooth boundary.

2Bt3—26 to 33 inches; brown (10YR 5/3) clay loam; common medium distinct yellowish brown (10YR 5/6) and few medium distinct light gray (10YR 6/1) mottles; weak medium subangular blocky structure; firm; few very fine roots; many distinct dark grayish brown (10YR 4/2) clay films on faces of peds; few fine soft dark accumulations and common medium soft dark accumulations of iron and manganese oxide; few pebbles; slight effervescence; mildly alkaline; clear smooth boundary.

2BC—33 to 40 inches; yellowish brown (10YR 5/4) clay loam; many medium distinct yellowish brown (10YR 5/6) and light gray (10YR 6/1) mottles; weak coarse subangular blocky structure; firm; common distinct dark gray (10YR 4/1) clay films on faces of peds; few fine soft dark accumulations of iron and

manganese oxide; few pebbles; strong effervescence; mildly alkaline; gradual wavy boundary.

2C—40 to 60 inches; yellowish brown (10YR 5/4) clay loam; many medium distinct yellowish brown (10YR 5/6) and light gray (10YR 6/1) mottles; massive; firm; few distinct dark grayish brown (10YR 4/2) stains on surfaces of planes; few medium soft dark accumulations of iron oxide and few fine soft dark accumulations of iron and manganese oxide; few pebbles; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 30 to 48 inches. The depth to free carbonates ranges from 20 to 40 inches. The thickness of the loess ranges from 10 to 20 inches. The content of clay in the control section ranges from 35 to 50 percent.

The Ap horizon has chroma of 1 or 2. The E horizon has value of 4 or 5 and chroma of 1 or 2. The Bt and 2Bt horizons have value of 4 to 6. The 2BC horizon has value of 4 to 6 and chroma of 2 to 6. The 2C horizon is clay loam or silty clay loam.

Camden Series

The Camden series consists of well drained, moderately permeable soils on outwash plains and stream terraces. These soils formed in loess and in the underlying glacial outwash. Slopes range from 2 to 10 percent.

Typical pedon of Camden silt loam, 2 to 5 percent slopes, 2,260 feet east and 2,180 feet north of the southwest corner of sec. 9, T. 31 N., R. 1 W.

Ap—0 to 8 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; weak fine and medium granular structure; friable; many very fine and fine roots; common distinct light gray (10YR 7/2 dry) silt coatings on faces of peds; medium acid; clear smooth boundary.

EB—8 to 12 inches; brown (10YR 4/3) silt loam; moderate fine and medium angular blocky structure parting to moderate fine and medium granular; friable; many very fine and fine roots; common distinct light gray (10YR 7/2 dry) silt coatings on faces of peds; slightly acid; clear smooth boundary.

Bt1—12 to 20 inches; dark yellowish brown (10YR 4/4) silty clay loam; strong fine and medium subangular blocky structure; friable; common very fine and fine roots; many distinct dark brown (10YR 3/3) clay films on faces of peds; common distinct light gray (10YR 7/2 dry) silt coatings on faces of peds; medium acid; clear smooth boundary.

Bt2—20 to 32 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; friable; common very fine and fine roots; common distinct dark brown (10YR 3/3) clay films on faces of peds; few distinct light gray (10YR 7/2 dry) silt coatings on faces of peds; few fine concretions of iron and manganese oxide; slightly acid; clear smooth boundary.

Bt3—32 to 38 inches; dark yellowish brown (10YR 4/4) silty clay loam; few fine distinct yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; friable; few very fine and fine roots; common distinct dark brown (10YR 3/3) clay films on faces of peds; few fine concretions of iron and manganese oxide; about 18 percent sand; slightly acid; clear smooth boundary.

2Bt4—38 to 51 inches; dark yellowish brown (10YR 4/4) loam; common fine and medium distinct yellowish brown (10YR 5/6) and common fine and medium prominent strong brown (7.5YR 5/8) mottles; moderate medium prismatic structure; friable; few very fine roots; common distinct dark brown (10YR 3/3) clay films on faces of peds; common fine concretions of iron and manganese oxide; slightly acid; clear smooth boundary.

2Bt5—51 to 60 inches; yellowish brown (10YR 5/4) loam; common fine and medium prominent yellowish brown (7.5YR 5/8) and common fine distinct light olive brown (2.5Y 5/4) mottles; weak medium prismatic structure; friable; few very fine roots; few distinct dark brown (10YR 3/3) clay films on faces of peds; neutral.

The solum is 59 or more inches thick. The thickness of the loess ranges from 24 to 40 inches.

The EB horizon has value of 4 or 5 and chroma of 3 or 4. The Bt horizon has value of 4 or 5 and chroma of 4 to 6. It is silt loam or silty clay loam. The 2Bt horizon has chroma of 4 to 6. It is loam, silty clay loam, or clay loam. Some pedons have a 2C horizon within a depth of 60 inches. This horizon is clay loam and has as much as 10 percent gravel.

Catlin Series

The Catlin series consists of moderately well drained, moderately permeable soils on glacial till plains and moraines. These soils formed in loess and in the underlying glacial till. Slopes range from 2 to 10 percent.

Typical pedon of Catlin silt loam, 2 to 5 percent slopes, 2,400 feet west and 944 feet south of the center of sec. 4, T. 32 N., R. 1 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; few very fine roots; slightly acid; clear smooth boundary.

A—7 to 12 inches; very dark grayish brown (10YR 3/2) and very dark brown (10YR 2/2) silty clay loam, grayish brown (10YR 5/2) and dark grayish brown (10YR 4/2) dry; weak medium subangular blocky structure parting to weak fine granular; friable; few very fine roots; medium acid; clear smooth boundary.

BA—12 to 17 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate fine subangular blocky structure; friable; few very fine roots; many distinct very dark grayish brown (10YR 3/2) organic coatings on faces of peds; slightly acid; clear smooth boundary.

Bt1—17 to 23 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate medium subangular blocky structure; friable; few very fine roots; many distinct dark brown (10YR 3/3) clay films on faces of peds; slightly acid; clear smooth boundary.

Bt2—23 to 31 inches; dark yellowish brown (10YR 4/4) silty clay loam; few fine and medium faint brown (10YR 5/3) and few fine and medium distinct dark yellowish brown (10YR 4/6) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; friable; few very fine roots; many distinct brown (10YR 4/3) clay films on faces of peds; slightly acid; clear smooth boundary.

Bt3—31 to 41 inches; brown (10YR 5/3) silty clay loam; common fine distinct dark yellowish brown (10YR 4/6) and few fine prominent grayish brown (2.5Y 5/2) mottles; weak medium prismatic structure; friable; few very fine roots; many distinct brown (10YR 4/3) clay films on faces of peds; few fine concretions of iron and manganese oxide; slightly acid; clear smooth boundary.

2BC—41 to 51 inches; brown (10YR 5/3) silt loam; common fine distinct dark yellowish brown (2.5Y 5/2) mottles; weak medium prismatic structure; friable; few very fine roots; few fine concretions of iron and manganese oxide; neutral; clear smooth boundary.

2C—51 to 60 inches; brown (10YR 5/3) silt loam; common medium distinct grayish brown (2.5Y 5/2) and common fine distinct dark yellowish brown (10YR 4/6) mottles; remnants of rock structure; firm; few very fine roots; about 20 percent sand; few pebbles; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 45 to more than 60 inches. The thickness of the loess and the depth to carbonates range from 40 to 60 inches. The mollic epipedon is 10 to 12 inches thick.

The Ap and A horizons have chroma of 1 to 3. The Bt horizon is dominantly silty clay loam but in some pedons is silt loam in the lower part. The 2BC horizon has hue of 10YR or 2.5Y and value of 4 or 5. It is silt loam, loam, or silty clay loam. The 2C horizon is silty clay loam, silt loam, or clay loam.

Catlin silt loam, 5 to 10 percent slopes, eroded, has a thinner dark surface layer than is definitive for the series. This difference, however, does not significantly affect the use or behavior of the soil.

Dakota Series

The Dakota series consists of well drained soils on stream terraces. These soils formed in outwash that is loamy in the upper part and sandy in the lower part. Permeability is moderate in the upper part of the profile and rapid in the lower part. Slopes range from 0 to 5 percent.

Typical pedon of Dakota loam, 2 to 5 percent slopes, eroded, 820 feet east and 1,820 feet north of the southwest corner of sec. 36, T. 33 N., R. 2 W.

Ap—0 to 10 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; moderate fine and medium granular structure; friable; few fine and many very fine roots; common distinct very dark gray (10YR 3/1) organic coatings on faces of peds; few pebbles; neutral; clear smooth boundary.

A—10 to 15 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate medium granular structure; friable; common very fine roots; common distinct very dark gray (10YR 3/1) organic coatings on faces of peds; neutral; clear smooth boundary.

Bt1—15 to 22 inches; brown (10YR 4/3) clay loam; moderate fine subangular blocky structure; friable; few fine and common very fine roots; common distinct very dark grayish brown (10YR 3/2) clay films on faces of peds; few fine soft dark accumulations of iron oxide; neutral; clear smooth boundary.

Bt2—22 to 31 inches; dark yellowish brown (10YR 4/4) clay loam; weak medium prismatic structure parting to moderate medium subangular blocky; friable; common very fine roots; common distinct brown (10YR 4/3) clay films on faces of peds; few pebbles; neutral; gradual wavy boundary.

2BC—31 to 35 inches; dark yellowish brown (10YR 4/4) loamy sand; weak coarse subangular blocky structure; very friable; few distinct brown (10YR 4/3) clay bridges; few pebbles; neutral; clear smooth boundary.

2C1—35 to 56 inches; yellowish brown (10YR 5/6) sand; single grain; loose; thin lamellae of dark yellowish brown (10YR 4/4) loamy sand; few pebbles; neutral; clear smooth boundary.
2C2—56 to 60 inches; brownish yellow (10YR 6/6) sand; single grain; loose; few pebbles; neutral.

The thickness of the solum ranges from 26 to 45 inches. The mollic epipedon ranges from 12 to 18 inches in thickness.

The Ap and A horizons have value and chroma of 2 or 3. They are loam, silt loam, or fine sandy loam. The Bt horizon is clay loam or loam. The 2C horizon has hue of 7.5YR or 10YR and value and chroma of 4 to 6. It is sand or coarse sand. Some pedons have strata of gravel.

Dakota loam, 2 to 5 percent slopes, eroded, has a thinner dark surface layer than is definitive for the series. This difference, however, does not significantly affect the use or behavior of the soil.

Downs Series

The Downs series consists of moderately well drained, moderately permeable soils on glacial till plains. These soils formed in loess. Slopes range from 2 to 5 percent.

Typical pedon of Downs silt loam, 2 to 5 percent slopes, 2,022 feet east and 780 feet south of the northwest corner of sec. 31, T. 14 N., R. 10 E.

Ap—0 to 8 inches; very dark brown (10YR 2/2) silt loam; weak medium and coarse granular structure; friable; common very fine and fine roots; slightly acid; clear smooth boundary.
BE—8 to 14 inches; brown (10YR 4/3) silt loam; weak fine and medium subangular blocky structure; friable; common very fine and fine roots; few distinct very dark grayish brown (10YR 3/2) clay films on faces of peds; few distinct very dark brown (10YR 2/2) organic coatings on faces of peds; slightly acid; clear smooth boundary.
Bt1—14 to 21 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate fine and medium subangular blocky structure; friable; common very fine and fine roots; few distinct dark brown (10YR 3/3) clay films on faces of peds; medium acid; clear smooth boundary.
Bt2—21 to 27 inches; dark yellowish brown (10YR 4/4) silty clay loam; few fine distinct (10YR 5/6) mottles; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; friable; common very fine and fine roots; few distinct dark brown (10YR 3/3) clay films on faces of peds; few fine dark concretions of iron and manganese oxide; medium acid; clear smooth boundary.
Bt3—27 to 37 inches; yellowish brown (10YR 5/4) silty clay loam; few fine distinct yellowish brown (10YR 5/8) and brownish yellow (10YR 6/8) mottles; weak medium prismatic structure parting to weak medium subangular blocky; friable; few very fine and fine roots; common distinct dark brown (10YR 3/3) clay films on faces of peds; common fine and medium dark concretions of iron and manganese oxide; slightly acid; gradual smooth boundary.
BC—37 to 51 inches; yellowish brown (10YR 5/4) silt loam; few fine distinct yellowish brown (10YR 5/8) and grayish brown (10YR 5/2) mottles; weak medium prismatic structure parting to weak medium subangular blocky; friable; few very fine roots; few distinct brown (10YR 5/3) clay films on faces of peds; common fine and medium dark concretions of iron and manganese oxide; slightly acid; gradual smooth boundary.
C—51 to 60 inches; yellowish brown (10YR 5/4) silt loam; common medium faint light yellowish brown (10YR 6/4) and few fine distinct grayish brown (10YR 5/2) mottles; massive; friable; few fine dark concretions of iron and manganese oxide; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 50 to 55 inches. The Ap horizon has value of 2 or 3. The Bt horizon has chroma of 3 or 4.

Drummer Series

The Drummer series consists of poorly drained, moderately slowly permeable soils on glacial till plains. These soils formed in loess and in the underlying glacial till. Slopes range from 0 to 2 percent.

Typical pedon of Drummer silty clay loam, till substratum, 450 feet north and 290 feet east of the southwest corner of sec. 36, T. 33 N., R. 1 W.

Ap—0 to 8 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; moderate medium granular structure; friable; common very fine roots; common fine accumulations of iron and manganese oxide; slightly acid; abrupt smooth boundary.
A—8 to 12 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; moderate medium granular structure; friable; common very fine roots; common fine accumulations of iron and manganese oxide; slightly acid; clear smooth boundary.
BA—12 to 17 inches; dark grayish brown (2.5Y 4/2) silty clay loam; common fine prominent yellowish brown (10YR 5/6) mottles; moderate fine subangular

blocky structure; friable; few very fine roots; many distinct very dark gray (10YR 3/1) organic coatings on faces of peds; common fine accumulations of iron and manganese oxide; slightly acid; clear smooth boundary.

Bg1—17 to 21 inches; dark grayish brown (2.5Y 4/2) silty clay loam; common fine prominent yellowish brown (10YR 5/6) mottles; moderate medium angular blocky structure; friable; few very fine roots; many distinct very dark grayish brown (10YR 3/2) organic coatings on faces of peds; krotovinas; common fine accumulations of iron and manganese oxide; neutral; clear smooth boundary.

Bg2—21 to 26 inches; dark grayish brown (2.5Y 4/2) silty clay loam; common medium distinct yellowish brown (10YR 5/6) mottles; moderate fine and medium prismatic structure parting to moderate fine angular blocky; friable; few very fine roots; many distinct very dark grayish brown (10YR 3/2) organic coatings on faces of peds; krotovinas; common fine accumulations of iron and manganese oxide; neutral; clear smooth boundary.

Bg3—26 to 34 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine prominent yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; friable; few very fine roots; many distinct dark grayish brown (10YR 4/2) coatings on faces of peds; common fine accumulations of iron and manganese oxide; neutral; clear smooth boundary.

Bg4—34 to 50 inches; grayish brown (2.5Y 5/2) silty clay loam; many fine prominent yellowish brown (10YR 5/6) mottles; weak medium prismatic structure; friable; few very fine roots; common fine accumulations of iron and manganese oxide; neutral; clear smooth boundary.

2BCg—50 to 59 inches; mottled gray (N 5/0) and light olive brown (2.5Y 5/4) loam; weak medium subangular blocky structure; firm; few very fine roots; common fine accumulations of iron and manganese oxide; few pebbles; slight effervescence; mildly alkaline; clear smooth boundary.

2Cg—59 to 65 inches; light olive brown (2.5Y 5/4) loam; common fine distinct gray (N 5/0) mottles; massive; firm; common fine accumulations of iron and manganese oxide; few pebbles; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 50 to 60 inches. The mollic epipedon ranges from 12 to 15 inches in thickness. The thickness of the loess and the depth to glacial till range from 40 to 60 inches.

The Ap and A horizons have chroma of 1 or 2. The Bg horizon has chroma of 1 or 2. The 2BCg and 2Cg horizons are loam, clay loam, or silty clay loam.

Fayette Series

The Fayette series consists of well drained, moderately permeable soils on glacial till plains. These soils formed in loess. Slopes range from 5 to 15 percent.

Typical pedon of Fayette silt loam, 5 to 10 percent slopes, eroded, 1,300 feet west and 2,200 feet south of the northeast corner of sec. 2, T. 14 N., R. 9 E.

Ap—0 to 6 inches; mixed dark grayish brown (10YR 4/2) and yellowish brown (10YR 5/4) silt loam, light brownish gray (10YR 6/2) and very pale brown (10YR 7/4) dry; moderate fine granular structure; friable; many very fine and few fine roots; neutral; abrupt smooth boundary.

Bt1—6 to 12 inches; yellowish brown (10YR 5/4) silty clay loam; moderate fine and medium subangular blocky structure; friable; many very fine roots; few distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; few fine soft dark accumulations of manganese oxide; medium acid; clear smooth boundary.

Bt2—12 to 22 inches; yellowish brown (10YR 5/4) silty clay loam; moderate medium prismatic structure parting to moderate medium subangular blocky; friable; many very fine and few medium roots; common distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; few fine soft dark accumulations of manganese oxide; very strongly acid; clear smooth boundary.

Bt3—22 to 30 inches; yellowish brown (10YR 5/4) silty clay loam; strong medium prismatic structure parting to moderate medium subangular blocky; friable; common very fine roots; many distinct brown (7.5YR 4/4) clay films on faces of peds; very few distinct very pale brown (10YR 7/3 dry) silt coatings on faces of peds; common fine soft dark accumulations of manganese oxide; strongly acid; clear smooth boundary.

Bt4—30 to 44 inches; yellowish brown (10YR 5/4) silty clay loam; few fine distinct grayish brown (10YR 5/2) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; friable; few very fine roots; common distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; few distinct very pale brown (10YR 7/3 dry) silt coatings on faces of peds; common fine soft dark accumulations of manganese oxide and few fine soft dark accumulations of iron oxide; strongly acid; gradual wavy boundary.

Bt5—44 to 50 inches; yellowish brown (10YR 5/4) silty clay loam; few fine distinct yellowish brown (10YR 5/6) and common fine distinct light brownish gray (10YR 6/2) mottles; weak coarse prismatic structure; friable; few very fine roots; common distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; few distinct very pale brown (10YR 7/3 dry) silt coatings on faces of peds; common fine soft dark accumulations of manganese oxide and few fine soft dark accumulations of iron oxide; strongly acid; gradual wavy boundary.

BC—50 to 60 inches; yellowish brown (10YR 5/4) silt loam; common medium distinct yellowish brown (10YR 5/6) and common fine distinct light brownish gray (10YR 6/2) mottles; weak coarse subangular blocky structure; friable; few very fine roots; few distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; few fine soft dark accumulations of manganese oxide and few fine and medium soft dark accumulations of iron oxide; neutral.

The thickness of the solum ranges from 50 to 70 inches. The depth to glacial till ranges from 50 to 75 inches. The Bt horizon has value of 4 or 5 and chroma of 3 or 4. Some pedons have a 2C horizon that is loam within a depth of 60 inches.

Flanagan Series

The Flanagan series consists of somewhat poorly drained, moderately permeable soils on glacial till plains. These soils formed in loess and in the underlying glacial till. Slopes range from 0 to 2 percent.

The Flanagan soils in Putnam County have a lower average content of clay in the B horizon than is definitive for the series. This difference, however, does not significantly affect the use or behavior of the soils.

Typical pedon of Flanagan silt loam, 1,100 feet west and 1,100 feet south of the northeast corner of sec. 27, T. 31 N., R. 1 W.

Ap—0 to 9 inches; black (10YR 2/1) silt loam, dark grayish brown (10YR 4/2) dry; moderate fine granular structure; friable; common very fine and fine roots; slightly acid; clear smooth boundary.

A—9 to 17 inches; very dark grayish brown (10YR 3/2) and black (10YR 2/1) silt loam, grayish brown (10YR 5/2) dry; moderate fine and medium granular structure; friable; common very fine and fine roots; slightly acid; clear smooth boundary.

BA—17 to 21 inches; dark grayish brown (10YR 4/2) silty clay loam; few fine distinct dark yellowish brown (10YR 4/6) mottles; moderate fine subangular blocky structure; friable; common very fine and fine roots; slightly acid; clear smooth boundary.

Bt1—21 to 28 inches; dark yellowish brown (10YR 4/4) silty clay loam; common fine distinct dark yellowish brown (10YR 4/6) mottles; strong fine subangular blocky structure; friable; common very fine and fine roots; common distinct very dark grayish brown (10YR 3/2) and few distinct dark grayish brown (10YR 4/2) clay films on faces of peds; few fine concretions of iron and manganese oxide; slightly acid; clear smooth boundary.

Bt2—28 to 33 inches; dark yellowish brown (10YR 4/4) silty clay loam; many medium distinct yellowish brown (10YR 5/6 and 5/8) mottles; strong medium subangular blocky structure; firm; few very fine roots; many distinct brown (10YR 4/3) and few distinct very dark grayish brown (10YR 3/2) clay films on faces of peds and in root channels; few fine concretions of iron and manganese oxide; slightly acid; clear smooth boundary.

Bt3—33 to 38 inches; light olive brown (2.5Y 5/4) silty clay loam; many medium prominent yellowish brown (10YR 5/8) and grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; friable; few very fine roots; common distinct grayish brown (2.5Y 5/2) clay films on faces of peds; few distinct very dark grayish brown (10YR 3/2) clay films in root channels; common fine and medium concretions of iron and manganese oxide; slightly acid; clear smooth boundary.

Bt4—38 to 51 inches; light olive brown (2.5Y 5/4) silty clay loam; many medium and coarse prominent dark yellowish brown (10YR 4/6) mottles; moderate coarse subangular blocky structure; friable; few very fine roots; common distinct grayish brown (2.5Y 5/2) clay films on faces of peds; few distinct very dark grayish brown (2.5Y 3/2) clay films in root channels; common fine and medium concretions of iron and manganese oxide; neutral; gradual smooth boundary.

2Bt5—51 to 54 inches; light olive brown (2.5Y 5/4) silty clay loam; common medium prominent olive gray (5Y 5/2) mottles; weak medium prismatic structure; friable; few very fine roots; common distinct grayish brown (10YR 5/2) clay films on faces of peds; common fine and medium concretions of iron and manganese oxide; few pebbles; neutral; clear smooth boundary.

2BC—54 to 60 inches; light olive brown (2.5Y 5/4) loam; common medium distinct grayish brown (2.5Y 5/2) mottles; weak medium prismatic structure; firm; few very fine roots; common distinct very dark gray (10YR 3/1) clay films in root channels; few pebbles; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 48 to more than 65 inches. The mollic epipedon is 14 to 17 inches thick. The thickness of the loess ranges from 40 to 55 inches.

The Bt horizon has chroma of 2 or 4. The 2Bt horizon has chroma of 2 to 6. It is loam, clay loam, or silty clay loam. Some pedons have a 2C horizon within a depth of 60 inches. This horizon is silty clay loam or loam.

Harpster Series

The Harpster series consists of poorly drained, moderately permeable soils on glacial till plains. These soils formed in loess. Slopes range from 0 to 2 percent.

Typical pedon of Harpster silty clay loam, 1,435 feet north and 810 feet west of the southeast corner of sec. 13, T. 32 N., R. 1 W.

Ap—0 to 10 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; moderate medium granular structure; friable; common very fine roots; common snail shells; violent effervescence; moderately alkaline; abrupt smooth boundary.

Ak—10 to 15 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; moderate medium granular structure; friable; common very fine roots; common snail shells; violent effervescence; mildly alkaline; clear smooth boundary.

Bg1—15 to 18 inches; olive gray (5Y 5/2) silty clay loam; moderate fine subangular blocky structure; friable; common very fine roots; common distinct black (10YR 2/1) organic coatings on faces of peds; slight effervescence; mildly alkaline; clear smooth boundary.

Bg2—18 to 23 inches; olive gray (5Y 5/2) silty clay loam; common fine prominent yellowish brown (10YR 5/6) mottles; moderate medium angular blocky structure; friable; common very fine roots; slight effervescence; mildly alkaline; clear smooth boundary.

Bg3—23 to 29 inches; light olive gray (5Y 6/2) silt loam; common fine prominent yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to moderate fine angular blocky; friable; strong effervescence; mildly alkaline; clear smooth boundary.

Bg4—29 to 46 inches; light olive gray (5Y 6/2) silt loam; many medium prominent yellowish brown (10YR 5/6) mottles; weak medium prismatic structure; friable; common very fine roots; strong effervescence; mildly alkaline; gradual smooth boundary.

Cg—46 to 60 inches; light olive gray (5Y 6/2) silt loam; many medium prominent yellowish brown (10YR 5/6) mottles; massive; friable; common very fine roots; violent effervescence; moderately alkaline.

The thickness of the solum ranges from 40 to 46 inches. The mollic epipedon is 12 to 18 inches thick.

A calcic horizon is within a depth of 16 inches. It has a calcium carbonate equivalent of 15 to 30 percent. The Bg horizon has hue of 2.5Y or 5Y, value of 4 or 5, and chroma of 1 or 2. It has a calcium carbonate equivalent of less than 15 percent.

Hennepin Series

The Hennepin series consists of well drained, moderately slowly permeable soils on glacial till plains. These soils formed in glacial till. Slopes range from 30 to 60 percent.

Typical pedon of Hennepin loam, 30 to 60 percent slopes, 900 feet north and 60 feet east of the southwest corner of sec. 26, T. 33 N., R. 1 W.

A—0 to 4 inches; dark brown (7.5YR 3/2) loam; moderate medium granular structure; friable; common fine roots; few pebbles; slight effervescence, mildly alkaline; clear smooth boundary.

Bw—4 to 10 inches; brown (7.5YR 5/4) clay loam; weak medium subangular blocky structure; friable; common fine roots; common distinct dark brown (7.5YR 3/2) organic coatings on faces of peds; few pebbles; slight effervescence; mildly alkaline; clear smooth boundary.

C—10 to 60 inches; brown (7.5YR 5/4) loam; massive; friable; few fine roots; about 3 percent pebbles; violent effervescence; moderately alkaline.

The thickness of the solum ranges from 10 to 18 inches. The A horizon has hue of 7.5YR or 10YR and value of 3 or 4. The Bw horizon is loam or clay loam.

Huntsville Series

The Huntsville series consists of moderately well drained, moderately permeable soils on flood plains. These soils formed in alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Huntsville silt loam, occasionally flooded, 426 feet east and 102 feet north of the center of sec. 18, T. 14 N., R. 8 E.

Ap—0 to 8 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; weak fine and medium granular structure; friable; common very fine and fine roots; neutral; abrupt smooth boundary.

A1—8 to 15 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; weak coarse and very coarse granular structure; friable; few very fine and fine roots; neutral; clear smooth boundary.

A2—15 to 22 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; weak very coarse granular structure; friable; few very fine and fine roots; neutral; clear smooth boundary.

A3—22 to 32 inches; black (10YR 2/1) and dark brown (10YR 3/3) silt loam, dark gray (10YR 4/1) and brown (10YR 5/3) dry; weak very coarse granular structure; few very fine roots; friable; neutral; clear smooth boundary.

A4—32 to 38 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; weak medium subangular blocky structure; friable; few very fine roots; neutral; gradual smooth boundary.

AC—38 to 60 inches; dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; massive; friable; few very fine roots; few faint very dark grayish brown (10YR 3/2) organic coatings on faces of desiccation cracks; neutral.

The solum and the mollic epipedon range from 36 to 60 inches in thickness. The C horizon is silt loam or loam.

Landes Series

The Landes series consists of well drained, moderately rapidly permeable soils on flood plains. These soils formed in alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Landes fine sandy loam, occasionally flooded, 1,500 feet east and 2,600 feet north of the southwest corner of sec. 13, T. 14 N., R. 9 E.

Ap—0 to 9 inches; very dark gray (10YR 3/1) fine sandy loam, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; common very fine roots; slightly acid; clear smooth boundary.

A—9 to 12 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; weak very fine subangular blocky structure parting to moderate medium granular; friable; common very fine roots; common distinct very dark gray (10YR 3/1) organic coatings on faces of peds; slightly acid; clear smooth boundary.

Bw1—12 to 21 inches; very dark grayish brown (10YR 3/2) loam, pale brown (10YR 6/3) dry; moderate fine subangular blocky structure; friable; few fine and common very fine roots; common distinct very dark gray (10YR 3/1) organic coatings on faces of peds; slightly acid; clear smooth boundary.

Bw2—21 to 31 inches; brown (10YR 4/3) fine sandy loam; weak medium prismatic structure parting to weak fine subangular blocky; friable; common very fine roots; common distinct very dark grayish brown (10YR 3/2) organic coatings on faces of peds; neutral; clear smooth boundary.

Bw3—31 to 38 inches; brown (10YR 4/3) fine sandy loam; weak medium subangular blocky structure; friable; common very fine roots; common distinct very dark grayish brown (10YR 3/2) organic coatings on faces of peds; neutral; clear smooth boundary.

C1—38 to 46 inches; brown (10YR 4/3) sandy loam; massive; friable; common very fine roots; common distinct very dark grayish brown (10YR 3/2) organic coatings in desiccation cracks; few fine soft dark accumulations of iron oxide; neutral; gradual smooth boundary.

C2—46 to 54 inches; brown (10YR 4/3) sandy loam; massive; very friable; common very fine roots; few distinct dark brown (10YR 3/3) organic coatings in desiccation cracks; few fine soft dark accumulations of iron and manganese oxide; few pebbles; neutral; clear smooth boundary.

C3—54 to 60 inches; brown (10YR 4/3) sandy loam; massive; very friable; few very fine roots; few coarse concretions of iron and manganese oxide; few pebbles; mildly alkaline.

The thickness of the solum ranges from 25 to 40 inches. The mollic epipedon ranges from 10 to 23 inches in thickness.

The Ap or A horizon has value of 2 or 3 and chroma of 1 or 2. The Bw horizon has value of 3 to 5 and chroma of 2 to 4. It is fine sandy loam, loam, or loamy fine sand. The C horizon has value of 4 or 5 and chroma of 3 or 4. It is commonly sandy loam or fine sand, but in some pedons it is stratified. Also, it contains as much as 10 percent gravel in some pedons.

Lanier Series

The Lanier series consists of well drained, very rapidly permeable soils on flood plains. These soils formed in alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Lanier gravelly sandy loam, occasionally flooded, 640 feet north and 760 feet east of the southwest corner of sec. 28, T. 14 N., R. 10 E.

Ap—0 to 7 inches; black (10YR 2/1) gravelly sandy loam, very dark grayish brown (10YR 3/2) dry; weak very fine granular structure; friable; many very fine roots; about 20 percent gravel; neutral; clear smooth boundary.

AC—7 to 11 inches; very dark grayish brown

(10YR 3/2) extremely gravelly loamy coarse sand, dark brown (10YR 3/3) dry; weak fine granular structure; very friable; common very fine roots; about 68 percent gravel; slight effervescence; mildly alkaline; clear wavy boundary.

C1—11 to 25 inches; brown (10YR 4/3) extremely gravelly coarse sand with thin strata of gravelly sandy loam; massive; loose; few very fine roots; about 60 percent gravel; strong effervescence; moderately alkaline; clear wavy boundary.

C2—25 to 60 inches; brown (10YR 4/3) very gravelly coarse sand; single grain; loose; about 45 percent gravel; strong effervescence; moderately alkaline.

The C horizon is very gravelly coarse sand, very gravelly loamy coarse sand, gravelly sandy loam, or very gravelly loamy sand.

Littleton Series

The Littleton series consists of somewhat poorly drained, moderately permeable soils on alluvial fans and stream terraces. These soils formed in alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Littleton silt loam, rarely flooded, 1,150 feet west and 312 feet north of the southeast corner of sec. 1, T. 14 N., R. 10 E.

Ap—0 to 7 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; moderate fine granular structure; friable; common fine roots; slightly acid; clear smooth boundary.

A—7 to 18 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; weak medium subangular blocky structure parting to weak fine granular; friable; common fine roots; slightly acid; clear smooth boundary.

AB—18 to 26 inches; very dark gray (10YR 3/1) silty clay loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure; friable; common fine roots; slightly acid; clear smooth boundary.

Bt1—26 to 37 inches; brown (10YR 4/3) silty clay loam; common fine faint yellowish brown (10YR 5/4) mottles; strong medium prismatic structure parting to moderate medium subangular blocky; firm; common very fine roots; many distinct very dark grayish brown (10YR 3/2) clay films on faces of peds; few fine concretions of iron and manganese oxide; slightly acid; clear smooth boundary.

Bt2—37 to 47 inches; grayish brown (10YR 5/2) silty clay loam; common fine distinct yellowish brown (10YR 5/6) and common fine faint brown (10YR 4/3) mottles; strong medium prismatic structure parting to moderate medium subangular blocky; firm; common very fine roots; many distinct dark grayish brown (10YR 4/2) clay films on faces of peds; few fine concretions of iron and manganese oxide; slightly acid; clear smooth boundary.

Bt3—47 to 60 inches; grayish brown (10YR 5/2) silty clay loam; common fine distinct yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure; firm; few very fine roots; few distinct black (10YR 2/1) organic coatings in root channels; common distinct dark grayish brown (10YR 4/2) clay films on faces of peds; few fine concretions of iron and manganese oxide; slightly acid.

The thickness of the solum ranges from 55 to 62 inches. The mollic epipedon is 24 to 30 inches thick and extends into the B horizon in some pedons.

The Ap and A horizons have chroma of 1 or 2. Some pedons have a C horizon within a depth of 60 inches. This horizon is silt loam or silty clay loam.

Martinsville Series

The Martinsville series consists of well drained, moderately permeable soils on stream terraces. These soils formed in glacial outwash. Slopes range from 0 to 10 percent.

Typical pedon of Martinsville fine sandy loam, 5 to 10 percent slopes, 560 feet west and 600 feet south of the northeast corner of sec. 25, T. 33 N., R. 2 W.

Ap—0 to 5 inches; mixed very dark grayish brown (10YR 3/2) and very dark brown (10YR 2/2) fine sandy loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; few very fine roots; neutral; abrupt smooth boundary.

BE—5 to 9 inches; brown (10YR 4/3) loam; weak thin platy structure; friable; few very fine roots; medium acid; clear smooth boundary.

Bt1—9 to 16 inches; brown (7.5YR 4/4) clay loam; moderate medium subangular blocky structure; friable; few very fine roots; common distinct dark yellowish brown (10YR 3/4) clay films on faces of peds; medium acid; clear smooth boundary.

Bt2—16 to 23 inches; brown (7.5YR 4/4) sandy clay loam; moderate medium subangular blocky structure; friable; few very fine roots; common distinct dark yellowish brown (10YR 3/4) clay films on faces of peds; medium acid; clear smooth boundary.

Bt3—23 to 37 inches; brown (7.5YR 4/4) sandy loam; moderate medium subangular blocky structure; friable; few very fine roots; common distinct dark

yellowish brown (10YR 3/4) clay films on faces of peds and bridging sand grains; strongly acid; clear smooth boundary.

Bt4—37 to 45 inches; brown (7.5YR 4/4) sandy loam; moderate medium subangular blocky structure; friable; few very fine roots; common distinct dark yellowish brown (10YR 3/4) clay films on faces of peds and bridging sand grains; medium acid; clear smooth boundary.

Bt5—45 to 56 inches; dark yellowish brown (10YR 4/4) loam; moderate medium subangular blocky structure; friable; few very fine roots; few distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; about 5 percent gravel; medium acid; gradual smooth boundary.

C—56 to 60 inches; brown (10YR 4/3) sandy loam; massive; friable; about 5 percent gravel; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 50 to 65 inches. Some pedons have a mantle of loess less than 15 inches thick.

The Ap horizon has value of 2 to 4 and chroma of 2 or 3. It is fine sandy loam or loam. The C horizon is commonly fine sand, loamy sand, or sandy loam, but in some pedons it is stratified. Also, in some pedons it contains between 5 and 15 percent gravel.

Martinsville loam, 0 to 2 percent slopes, has more sand and less clay in the control section than is definitive for the series. This difference, however, does not significantly affect the use or behavior of the soil.

Metea Series

The Metea series consists of well drained soils on glacial till plains. The soils formed in sandy and loamy eolian material and in the underlying glacial till. Permeability is rapid in the upper part of the profile and moderate in the lower part. Slopes range from 5 to 15 percent.

Typical pedon of Metea loamy fine sand, 10 to 15 percent slopes, 2,280 feet west and 1,060 feet south of the northeast corner of sec. 14, T. 32 N., R. 2 W.

Ap—0 to 6 inches; brown (10YR 4/3) loamy fine sand, pale brown (10YR 6/3) dry; weak very fine granular structure; very friable; common very fine roots; medium acid; clear smooth boundary.

E1—6 to 21 inches; dark yellowish brown (10YR 4/4) loamy fine sand; weak thick platy structure parting to weak fine and medium subangular blocky; very friable; common very fine roots; medium acid; gradual smooth boundary.

E2—21 to 27 inches; yellowish brown (10YR 5/4) loamy fine sand; weak thick platy structure parting to moderate medium subangular blocky; very friable; few very fine roots; medium acid; clear smooth boundary.

Bt1—27 to 33 inches; yellowish brown (10YR 5/4) sandy loam; weak coarse prismatic structure parting to moderate medium subangular blocky; friable; few very fine roots; common faint dark yellowish brown (10YR 4/4) clay films on faces of peds; medium acid; clear smooth boundary.

Bt2—33 to 37 inches; yellowish brown (10YR 5/6) sandy loam; common fine distinct brown (10YR 5/3) mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; friable; few very fine roots; common distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; few pebbles; slightly acid; clear wavy boundary.

2Bt3—37 to 53 inches; brown (7.5YR 5/4) clay loam; weak coarse prismatic structure; very firm; few very fine roots; very few distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; few fine soft accumulations of iron and manganese oxide; about 2 percent fine gravel; neutral; clear smooth boundary.

2C—53 to 60 inches; brown (7.5YR 5/4) loam; massive; very firm; few fine soft accumulations of iron and manganese oxide; about 2 percent fine gravel; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 40 to 55 inches. The thickness of the eolian material ranges from 20 to 40 inches.

The Ap horizon has value of 4 or 5 and chroma of 3 or 4. The E horizon has value of 4 or 5. It is loamy fine sand or fine sand. The Bt horizon has chroma of 4 to 6. It is sandy loam or sandy clay loam. The 2Bt horizon has hue of 7.5YR or 10YR. It is loam or clay loam. It is neutral or slightly acid. The 2C horizon has hue of 7.5YR or 10YR.

Miami Series

The Miami series consists of well drained, moderately permeable soils on glacial till plains. These soils formed in glacial till. Slopes range from 5 to 30 percent.

Typical pedon of Miami loam, 10 to 18 percent slopes, eroded, 1,440 feet north and 1,060 feet east of the southwest corner of sec. 25, T. 33 N., R. 1 W.

Ap—0 to 7 inches; brown (10YR 4/3) loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; common fine and medium roots; few pebbles; neutral; abrupt smooth boundary.

Bt1—7 to 15 inches; dark yellowish brown (10YR 4/4) clay loam; weak fine prismatic structure parting to moderate medium subangular blocky; friable; common very fine and fine roots; common faint brown (10YR 4/3) clay films and common distinct very pale brown (10YR 7/3 dry) silt coatings on faces of peds; few fine concretions of iron and manganese oxide; few pebbles; medium acid; clear smooth boundary.

Bt2—15 to 25 inches; brown (7.5YR 4/4) clay loam; many medium distinct strong brown (7.5YR 4/6) relict mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; common very fine roots; common distinct dark yellowish brown (10YR 3/4) clay films and common distinct light gray (10YR 7/1 dry) silt coatings on faces of peds; few fine concretions of iron and manganese oxide; few pebbles; medium acid; clear smooth boundary.

Bt3—25 to 38 inches; brown (7.5YR 4/4) clay loam; many medium distinct strong brown (7.5YR 4/6) relict mottles; weak coarse prismatic structure; firm; few very fine roots; common distinct dark yellowish brown (10YR 3/4) clay films and common distinct light gray (10YR 7/1 dry) silt coatings on faces of peds; few fine concretions of iron and manganese oxide; few pebbles; neutral; clear smooth boundary.

C—38 to 60 inches; brown (7.5YR 5/4) clay loam; many medium distinct strong brown (7.5YR 4/6) relict mottles; massive; firm; few very fine roots; few fine concretions of iron and manganese oxide; common pebbles; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 32 to 40 inches. The depth to carbonates ranges from 26 to 38 inches.

The Ap horizon is loam or silt loam. Some pedons in uncultivated areas have an A horizon and an E or BE horizon. These horizons are loam or silt loam. The Ap or A horizon has value of 2 or 3 and chroma of 2. The E or BE horizon has value of 3 or 4 and chroma of 2 or 3. The Bt horizon has value of 4 or 5 and chroma of 3 or 4. It is loam or clay loam. The C horizon is loam or clay loam.

Morley Series

The Morley series consists of well drained and moderately well drained, slowly permeable soils on glacial till plains. These soils formed in glacial till. Slopes range from 5 to 35 percent.

Typical pedon of Morley silt loam, 18 to 35 percent slopes, 1,480 feet north and 320 feet west of the southeast corner of sec. 17, T. 31 N., R. 1 W.

A—0 to 3 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; weak fine granular structure; friable; common fine and medium roots; few fine concretions of iron and manganese oxide; few pebbles; slightly acid; clear smooth boundary.

E—3 to 7 inches; dark grayish brown (10YR 4/2) silt loam; weak thick platy structure parting to weak fine subangular blocky; friable; common fine and medium roots; few fine concretions of iron and manganese oxide; few pebbles; slightly acid; clear smooth boundary.

BE—7 to 10 inches; dark grayish brown (10YR 4/2) silty clay loam; weak medium subangular blocky structure; friable; common very fine and fine roots; common distinct very dark grayish brown (10YR 3/2) organic coatings on faces of peds; few fine concretions of iron and manganese oxide; few pebbles; slightly acid; clear smooth boundary.

Bt1—10 to 18 inches; brown (10YR 4/3) silty clay loam; moderate medium subangular blocky structure; firm; common very fine and fine roots; many distinct very dark grayish brown (10YR 3/2) clay films on faces of peds; few fine concretions of iron and manganese oxide; few pebbles; slightly acid; clear smooth boundary.

Bt2—18 to 28 inches; brown (10YR 4/3) clay loam; few fine distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; firm; few very fine roots; common distinct dark brown (10YR 3/3) clay films on faces of peds; few fine concretions of iron and manganese oxide; common pebbles; slight effervescence; mildly alkaline; clear smooth boundary.

BC—28 to 37 inches; olive brown (2.5Y 4/4) clay loam; few fine prominent yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; very firm; few very fine roots; few fine concretions of iron and manganese oxide; common pebbles; strong effervescence; mildly alkaline; clear smooth boundary.

C—37 to 60 inches; olive brown (2.5Y 4/4) clay loam; few fine prominent yellowish brown (10YR 5/6) mottles; massive; very firm; few very fine roots; few fine concretions of iron and manganese oxide; common pebbles; strong effervescence; moderately alkaline.

The thickness of the solum ranges from 20 to 37 inches. The depth to carbonates ranges from 12 to 18 inches.

The A or Ap horizon has chroma of 1 or 2. It is silt loam or silty clay loam. In many cultivated areas the E horizon has been mixed into the Ap horizon. The Bt

horizon has chroma of 3 or 4. It is clay loam, silty clay loam, or silty clay.

Moundprairie Series

The Moundprairie series consists of poorly drained, moderately permeable soils on flood plains. These soils formed in alluvium. Slopes are 0 to 1 percent.

Typical pedon of Moundprairie silty clay loam, frequently flooded, 1,600 feet east and 1,540 feet north of the center of sec. 25, T. 33 N., R. 1 W.

Ap—0 to 9 inches; mixed very dark gray (10YR 3/1) and very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; common very fine roots; few fine concretions of iron and manganese oxide; strong effervescence; moderately alkaline; clear smooth boundary.

Cg1—9 to 25 inches; very dark gray (10YR 3/1) silty clay loam; thin strata of very dark grayish brown (2.5Y 3/2) sandy loam and silt loam; common fine prominent dark yellowish brown (10YR 4/6) mottles; appears massive but has weak bedding planes; friable; common very fine roots; few fine concretions of iron and manganese oxide; strong effervescence; mildly alkaline; clear smooth boundary.

Cg2—25 to 39 inches; very dark gray (10YR 3/1) silty clay loam; many medium faint very dark grayish brown (2.5Y 3/2) and few fine prominent dark yellowish brown (10YR 4/6) mottles; appears massive but has weak bedding planes; friable; few very fine roots; few fine and medium concretions of iron and manganese oxide; slight effervescence; mildly alkaline; clear smooth boundary.

Ab—39 to 60 inches; black (5Y 2.5/1) silty clay loam, dark gray (5Y 4/1) dry; many medium distinct very dark grayish brown (10YR 3/2) and few fine prominent dark brown (10YR 4/3) mottles; appears massive but has weak bedding planes; friable; few very fine roots; few fine and medium concretions of iron and manganese oxide; slight effervescence; mildly alkaline.

Depth to the buried soil ranges from 20 to 60 inches. The Ap or A horizon has value of 2 or 3 and chroma of 1 or 2. The Cg horizon has value of 2 to 5 and chroma of 1 or 2. It is silty clay loam that has thin strata of silt loam, loam, sandy loam, or loamy very fine sand.

Muscatine Series

The Muscatine series consists of somewhat poorly drained, moderately permeable soils on glacial till plains. These soils formed in loess. Slopes range from 0 to 2 percent.

The Muscatine soils in Putnam County are taxadjuncts to the series because they have an argillic horizon. This difference, however, does not significantly affect the use or behavior of the soils.

Typical pedon of Muscatine silt loam, 2,540 feet north and 1,600 feet east of the southwest corner of sec. 11, T. 32 N., R. 1 W.

Ap—0 to 8 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; moderate medium granular structure; friable; many very fine roots; medium acid; abrupt smooth boundary.

A—8 to 14 inches; very dark grayish brown (10YR 3/2) silt loam, dark gray (10YR 4/1) dry; moderate medium granular structure; friable; common very fine roots; many distinct black (10YR 2/1) organic coatings on faces of peds; medium acid; clear smooth boundary.

BA—14 to 17 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate fine and medium subangular blocky structure; friable; common very fine roots; common distinct very dark gray (10YR 3/1) organic coatings on faces of peds; slightly acid; clear smooth boundary.

Bt—17 to 21 inches; dark grayish brown (10YR 4/2) silty clay loam; moderate fine subangular blocky structure; friable; common very fine roots; many distinct very dark grayish brown (10YR 3/2) clay films on faces of peds; slightly acid; clear smooth boundary.

Btg1—21 to 30 inches; grayish brown (10YR 5/2) silty clay loam; common fine distinct yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; friable; common very fine roots; common distinct dark grayish brown (10YR 4/2) clay films on faces of peds; slightly acid; clear smooth boundary.

Btg2—30 to 40 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine prominent strong brown (7.5YR 5/6) mottles; moderate medium prismatic structure parting to moderate medium angular blocky; friable; few very fine roots; common distinct dark grayish brown (2.5Y 4/2) and few distinct very dark grayish brown (10YR 3/2) clay films on faces of peds; neutral; clear smooth boundary.

Btg3—40 to 52 inches; grayish brown (2.5Y 5/2) silty clay loam; common fine prominent strong brown (7.5YR 5/6) mottles; weak medium prismatic structure parting to weak medium subangular blocky; friable; few very fine roots; few distinct dark

grayish brown (2.5Y 4/2) clay films on faces of peds; neutral; clear smooth boundary.

Cg—52 to 60 inches; grayish brown (2.5Y 5/2) silt loam; common fine prominent strong brown (7.5YR 5/6) mottles; massive; friable; few very fine roots; mildly alkaline.

The thickness of the solum ranges from 45 to 55 inches. The depth to carbonates ranges from 48 to 60 inches in some pedons. The mollic epipedon is 14 to 20 inches thick. The lower part of the Bt horizon is silt loam in some pedons.

Orio Series

The Orio series consists of poorly drained soils on outwash plains and stream terraces. These soils formed in glacial outwash or alluvium. Permeability is moderately slow in the upper part of the profile and rapid in the lower part. Slopes range from 0 to 2 percent.

The Orio soils in Putnam County have a thicker dark surface layer than is definitive for the series. This difference, however, does not significantly affect the use or behavior of the soils.

Typical pedon of Orio fine sandy loam, 600 feet south and 60 feet west of the center of sec. 7, T. 31 N., R. 1 W.

Ap—0 to 12 inches; very dark brown (10YR 2/2) fine sandy loam, dark grayish brown (10YR 4/2) dry; moderate fine granular structure; friable; common fine roots; medium acid; abrupt smooth boundary.

E—12 to 21 inches; dark grayish brown (10YR 4/2) fine sandy loam; many fine distinct yellowish brown (10YR 5/6) mottles; weak medium platy structure; friable; common fine roots; strongly acid; clear smooth boundary.

Btg1—21 to 29 inches; dark gray (10YR 4/1) clay loam; many fine prominent strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; friable; common fine roots; many distinct very dark gray (10YR 3/1) clay films on faces of peds; medium acid; clear smooth boundary.

Btg2—29 to 42 inches; grayish brown (2.5YR 5/2) clay loam; many fine prominent strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; friable; common fine roots; common distinct very dark grayish brown (10YR 3/2) organic coatings and many distinct dark gray (10YR 4/1) clay films on faces of peds; medium acid; abrupt wavy boundary.

Cg1—42 to 47 inches; grayish brown (2.5Y 5/2) fine sand; single grain; loose; slightly acid; gradual smooth boundary.

Cg2—47 to 60 inches; dark grayish brown (10YR 4/2) loamy fine sand; many fine prominent strong brown (7.5YR 5/6) mottles; single grain; loose; neutral.

The thickness of the solum ranges from 35 to 50 inches. The E horizon is fine sandy loam, sandy loam, or loam. The Btg horizon commonly is sandy clay loam or clay loam. The Cg horizon is loamy fine sand, fine sand, or sand.

Ridgeville Series

The Ridgeville series consists of somewhat poorly drained, moderately rapidly permeable soils on stream terraces and outwash plains. These soils formed in glacial outwash or alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Ridgeville fine sandy loam, 1,940 feet north and 2,400 feet east of the southwest corner of sec. 6, T. 31 N., R. 1 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; common fine roots; slightly acid; abrupt smooth boundary.

A—7 to 11 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; weak medium granular structure; very friable; common fine roots; slightly acid; clear smooth boundary.

Bt1—11 to 17 inches; brown (10YR 4/3) fine sandy loam; few fine faint grayish brown (10YR 5/2) and common fine distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; common fine roots; few distinct very dark grayish brown (10YR 3/2) clay films on faces of peds; medium acid; clear smooth boundary.

Bt2—17 to 27 inches; brown (10YR 5/3) fine sandy loam; few fine faint grayish brown (10YR 5/2) and many fine distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; few fine roots; common distinct dark brown (10YR 4/3) clay films on faces of peds; medium acid; clear smooth boundary.

Btg1—27 to 35 inches; mottled light brownish gray (10YR 6/2) and yellowish brown (10YR 5/6) fine sand; weak medium subangular blocky structure; very friable; few fine roots; few faint grayish brown (10YR 5/2) clay films bridging sand grains; slightly acid; clear smooth boundary.

Btg2—35 to 47 inches; mottled grayish brown (10YR 5/2) and strong brown (7.5YR 5/6) loamy fine sand; weak medium subangular blocky structure; very friable; few fine roots; many faint grayish brown

(10YR 5/2) clay films bridging sand grains; slightly acid; clear smooth boundary.

Cg—47 to 60 inches; mottled grayish brown (10YR 5/2) and strong brown (7.5YR 5/6) fine sand; single grain; loose; slightly acid.

The thickness of the solum ranges from 40 to 50 inches. The mollic epipedon ranges from 10 to 18 inches in thickness.

The Ap and A horizons have value and chroma of 2 or 3. They are fine sandy loam or loam. The Bt and Btg horizons are fine sandy loam, sandy clay loam, loam, loamy fine sand, or fine sand. The Cg horizon is fine sand or sand. Some pedons have strata of loam, sandy loam, or loamy fine sand.

Rodman Series

The Rodman series consists of excessively drained soils on stream terraces. These soils formed in alluvium. Permeability is moderately rapid in the upper part of the profile and very rapid in the lower part. Slopes range from 2 to 60 percent.

Typical pedon of Rodman gravelly sandy loam, 30 to 60 percent slopes, 960 feet west and 1,870 feet south of the northeast corner of sec. 16, T. 32 N., R. 2 W.

A—0 to 6 inches; black (10YR 2/1) gravelly sandy loam, dark grayish brown (10YR 4/2) dry; moderate fine granular structure; friable; few fine roots; about 20 percent gravel; slight effervescence; mildly alkaline; clear smooth boundary.

Bw—6 to 14 inches; brown (10YR 4/3) gravelly sandy loam; weak fine granular structure; very friable; few very fine roots; many distinct dark brown (10YR 3/3) organic coatings on faces of peds; about 25 percent gravel; strong effervescence; mildly alkaline; clear smooth boundary.

C1—14 to 19 inches; brown (10YR 5/3) very gravelly sandy loam; massive; very friable; few fine and very fine roots; about 40 percent gravel; violent effervescence; moderately alkaline; clear smooth boundary.

C2—19 to 60 inches; yellowish brown (10YR 5/4) extremely gravelly very coarse sand; single grain; loose; about 65 percent gravel; violent effervescence; moderately alkaline.

The thickness of the solum ranges from 8 to 15 inches. The A or Ap horizon has value of 2 or 3 and chroma of 1 or 2. It is gravelly sandy loam or gravelly loam. The Bw horizon has value and chroma of 3 or 4. It is gravelly loam, gravelly sandy loam, or gravelly coarse sandy loam. The C horizon is sandy loam, coarse sandy loam, very coarse sandy loam, loamy sand, coarse loamy sand, very coarse loamy sand, sand, coarse sand, or very coarse sand. It ranges from 35 to 70 percent gravel.

Rozetta Series

The Rozetta series consists of moderately well drained, moderately permeable soils on glacial till plains. These soils formed in loess. Slopes range from 2 to 5 percent.

Typical pedon of Rozetta silt loam, 2 to 5 percent slopes, 2,395 feet north and 2,510 feet east of the southwest corner of sec. 1, T. 14 N., R. 9 E.

Ap—0 to 9 inches; mixed dark brown (10YR 4/3) and brown (10YR 5/3) silt loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; common fine roots; slightly acid; abrupt smooth boundary.

Bt1—9 to 19 inches; dark yellowish brown (10YR 4/6) silty clay loam; moderate fine subangular blocky structure; friable; common fine roots; many distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; medium acid; clear smooth boundary.

Bt2—19 to 27 inches; dark yellowish brown (10YR 4/6) silty clay loam; moderate medium subangular blocky structure; friable; few fine roots; many distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; medium acid; clear smooth boundary.

Bt3—27 to 35 inches; dark yellowish brown (10YR 4/6) silty clay loam; few fine prominent light brownish gray (10YR 6/2) and common fine distinct strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; friable; few fine roots; many distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; common fine stains of iron and manganese oxide on faces of peds; medium acid; clear smooth boundary.

Bt4—35 to 46 inches; yellowish brown (10YR 5/4) silt loam; few fine distinct light brownish gray (10YR 6/2) and common fine prominent strong brown (7.5YR 5/6) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; friable; few fine roots; common distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; common fine stains of iron and manganese oxide; medium acid; clear smooth boundary.

Bt5—46 to 55 inches; yellowish brown (10YR 5/4) silt loam; few fine distinct light brownish gray (10YR 6/2) and common fine prominent strong brown (7.5YR 5/6) mottles; moderate medium prismatic structure; friable; few fine roots; common distinct dark yellowish brown (10YR 4/4) clay films on faces of peds; common fine accumulations of iron and

manganese oxide; slightly acid; clear smooth boundary.

BC—55 to 60 inches; yellowish brown (10YR 5/4) silt loam; few fine distinct light brownish gray (10YR 6/2) and common fine prominent strong brown (7.5YR 5/6) mottles; weak medium prismatic structure; friable; few fine roots; few distinct dark yellowish brown (10YR 4/4) clay linings in root channels; common fine accumulations of iron and manganese oxide; neutral.

The thickness of the solum ranges from 55 to 65 inches. Some pedons in uncultivated areas have an E horizon. This horizon is silt loam. It has hue of 10YR, value of 4, and chroma of 2 or 3. Some pedons have a C horizon within a depth of 60 inches. This horizon has hue of 10YR, value of 4 to 6, and chroma of 2 to 4. It is silt loam.

Sabina Series

The Sabina series consists of somewhat poorly drained, moderately slowly permeable soils on glacial till plains. These soils formed in loess and in the underlying glacial till. Slopes range from 0 to 2 percent.

Typical pedon of Sabina silt loam, 2,480 feet east and 1,300 feet north of the southwest corner of sec. 34, T. 31 N., R. 1 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, pale brown (10YR 6/3) dry; weak fine granular structure; friable; common very fine roots; neutral; abrupt smooth boundary.

E—7 to 14 inches; dark grayish brown (10YR 4/2) silt loam; few fine distinct yellowish brown (10YR 5/6) mottles; moderate medium platy structure parting to moderate very fine subangular blocky; friable; common very fine roots; common distinct light gray (10YR 6/2 dry) silt coatings on faces of peds; few fine soft dark accumulations of iron and manganese oxide; slightly acid; clear smooth boundary.

Bt1—14 to 21 inches; dark grayish brown (10YR 4/2) silty clay loam; common fine distinct yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to moderate fine subangular blocky; friable; common very fine roots; many distinct very dark grayish brown (10YR 3/2) clay films and few distinct light gray (10YR 7/2 dry) silt coatings on faces of peds; few fine soft dark accumulations of iron and manganese oxide; medium acid; clear smooth boundary.

Bt2—21 to 27 inches; brown (10YR 5/3) silty clay loam; many fine and medium distinct yellowish brown (10YR 5/6) and common fine faint grayish brown (10YR 5/2) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; friable; common very fine roots; many distinct dark brown (10YR 3/3) and few distinct dark grayish brown (10YR 4/2) clay films on faces of peds; few fine soft dark accumulations of iron and manganese oxide; medium acid; gradual smooth boundary.

Bt3—27 to 36 inches; brown (10YR 5/3) silty clay loam; many fine distinct yellowish brown (10YR 5/6) and common fine faint grayish brown (10YR 5/2) mottles; weak medium prismatic structure parting to moderate medium angular blocky; friable; few very fine roots; many distinct very dark gray (10YR 3/1) and very dark grayish brown (10YR 3/2) clay films on faces of peds; few fine soft dark accumulations of iron and manganese oxide; slightly acid; gradual smooth boundary.

Bt4—36 to 48 inches; brown (10YR 5/3) silty clay loam; many fine and medium distinct yellowish brown (10YR 5/6) and many fine and medium faint grayish brown (10YR 5/2) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; friable; few very fine roots; common distinct black (N 2/0) and few distinct very dark grayish brown (10YR 3/2) clay films on faces of peds; few fine soft dark accumulations of iron and manganese oxide; neutral; clear smooth boundary.

2BC—48 to 53 inches; brown (10YR 5/3) silty clay loam; many fine distinct yellowish brown (10YR 5/6), common fine faint light brownish gray (10YR 6/2), and common fine faint grayish brown (10YR 5/2) mottles; weak coarse subangular blocky structure; friable; few distinct dark grayish brown (10YR 4/2) clay films on faces of peds; few fine soft dark accumulations of manganese oxide, common medium soft dark accumulations of iron oxide, and common medium concretions of calcium carbonate; about 2 percent gravel; mildly alkaline; clear smooth boundary.

2C—53 to 60 inches; brown (10YR 5/3) clay loam; many fine distinct yellowish brown (10YR 5/6) and common fine distinct light brownish gray (2.5Y 6/2) mottles; massive; friable; common medium soft dark accumulations of iron oxide, few fine soft dark accumulations of manganese oxide, and few fine concretions of calcium carbonate; about 3 percent gravel; slight effervescence; mildly alkaline.

The thickness of the solum and the depth to carbonates range from 48 to 60 inches. The E horizon has value of 4 or 5. The Bt horizon is silty clay loam or silty clay. The 2BC horizon is clay loam or silty clay

loam. The content of gravel in the 2BC and 2C horizons ranges from 2 to 5 percent. The 2C horizon is clay loam, silty clay loam, or loam.

Sable Series

The Sable series consists of poorly drained, moderately permeable soils on glacial till plains. These soils formed in loess. Slopes range from 0 to 2 percent.

Typical pedon of Sable silty clay loam, 2,660 feet east and 2,610 feet north of the southwest corner of sec. 23, T. 32 N., R. 1 W.

Ap—0 to 9 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; moderate medium granular structure; friable; common fine roots; slightly acid; abrupt smooth boundary.

A—9 to 14 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; moderate fine subangular blocky structure parting to moderate medium granular; friable; common fine roots; neutral; clear smooth boundary.

BA—14 to 19 inches; very dark gray (10YR 3/1) silty clay loam, gray (10YR 5/1) dry; weak fine subangular blocky structure; friable; common fine roots; many distinct black (10YR 2/1) organic coatings on faces of peds; neutral; clear smooth boundary.

Bg1—19 to 26 inches; olive gray (5Y 5/2) silty clay loam; few fine faint grayish brown (2.5Y 5/2) and common medium prominent yellowish brown (10YR 5/6) mottles; moderate fine prismatic structure parting to moderate medium subangular blocky; friable; common fine roots; neutral; clear smooth boundary.

Bg2—26 to 36 inches; light olive gray (5Y 6/2) silty clay loam; common medium faint olive gray (5Y 4/2) and common fine prominent yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; friable; few fine roots; neutral; clear smooth boundary.

BCg—36 to 47 inches; light olive gray (5Y 6/2) silt loam; common medium prominent yellowish brown (10YR 5/6) mottles; weak medium prismatic structure; friable; few fine roots; neutral; clear smooth boundary.

Cg—47 to 60 inches; light olive gray (5Y 6/2) silt loam; moderate medium prominent yellowish brown (10YR 5/6) mottles; massive; friable; slight effervescence; mildly alkaline.

The thickness of the solum and the depth to carbonates range from 40 to 50 inches. The mollic epipedon is 17 to 20 inches thick.

The Ap and A horizons have value of 2 or 3. The Bg horizon has value of 4 to 6 and chroma of 1 or 2.

Sawmill Series

The Sawmill series consists of poorly drained, moderately permeable soils on flood plains. These soils formed in alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Sawmill silty clay loam, rarely flooded, 2,540 feet south and 2,580 feet west of the northeast corner of sec. 21, T. 32 N., R. 2 W.

Ap—0 to 8 inches; black (N 2/0) silty clay loam, dark gray (N 4/0) dry; moderate medium subangular blocky structure; firm; few fine roots; mildly alkaline; clear smooth boundary.

A—8 to 23 inches; black (N 2/0) silty clay loam, dark gray (N 4/0) dry; few fine prominent yellowish red (5YR 4/6) mottles; strong medium angular blocky structure; firm; few fine roots; neutral; clear smooth boundary.

Bg1—23 to 32 inches; very dark gray (10YR 3/1) silty clay loam, gray (10YR 5/1) dry; common medium prominent yellowish red (5YR 4/6) mottles; strong medium angular blocky structure; firm; few very fine roots; neutral; gradual smooth boundary.

Bg2—32 to 43 inches; dark gray (10YR 4/1) silty clay loam; many fine prominent yellowish red (5YR 4/6) mottles; weak medium angular blocky structure; friable; few very fine roots; mildly alkaline; gradual smooth boundary.

Cg—43 to 60 inches; dark gray (10YR 4/1) silty clay loam; common fine prominent yellowish red (5YR 4/6) mottles; friable; few very fine roots; mildly alkaline.

The thickness of the solum ranges from 40 to 60 inches. The mollic epipedon is 24 to 36 inches thick.

The Ap and A horizons have hue of 10YR or are neutral in hue. They have value of 2 or 3 and chroma of 0 to 2. The Bg horizon has hue of 10YR or 2.5Y. In some pedons the lower part of the Bg horizon and the Cg horizon are stratified silty clay loam, clay loam, loam, or silt loam.

Saybrook Series

The Saybrook series consists of moderately well drained, moderately permeable soils on glacial till plains. These soils formed in loess and in the underlying glacial till. Slopes range from 5 to 10 percent.

The Saybrook soils in Putnam County have a thinner dark surface layer than is definitive for the series. This

difference, however, does not significantly affect the use or behavior of the soils.

Typical pedon of Saybrook silt loam, 5 to 10 percent slopes, eroded, 600 feet south and 900 feet west of the northeast corner of sec. 5, T. 31 N., R. 1 W.

Ap—0 to 8 inches; mixed very dark gray (10YR 3/1) and very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak medium subangular blocky structure parting to weak fine granular; friable; few very fine roots; few fine soft accumulations of iron and manganese oxide; neutral; abrupt smooth boundary.

BA—8 to 15 inches; brown (10YR 4/3) silty clay loam, brown (10YR 5/3) dry; weak medium granular structure; friable; few very fine roots; many prominent very dark gray (10YR 3/1) organic coatings on faces of peds; few fine soft accumulations of iron and manganese oxide; neutral; clear smooth boundary.

Bt1—15 to 25 inches; dark yellowish brown (10YR 4/4) silty clay loam; few medium distinct light olive brown (2.5Y 5/4) mottles; strong medium subangular blocky structure; friable; few very fine roots; many distinct dark brown (10YR 4/3) clay films on faces of peds; few fine soft accumulations of iron and manganese oxide; neutral; clear smooth boundary.

2Bt2—25 to 34 inches; light olive brown (2.5Y 5/4) clay loam; few fine prominent yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; firm; few very fine roots; common distinct dark brown (10YR 4/3) clay films on faces of peds; few fine soft accumulations of iron and manganese oxide; about 2 percent gravel; slight effervescence; mildly alkaline; clear smooth boundary.

2C—34 to 60 inches; light olive brown (2.5Y 5/4) clay loam; common medium prominent yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure (remnant of rock structure); firm; few fine and medium soft accumulations of iron and manganese oxide; about 3 percent gravel; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 34 to 42 inches. The depth to carbonates ranges from 25 to 38 inches.

The Ap horizon has value of 2 or 3. The 2Bt horizon has hue of 10YR or 2.5Y. The content of gravel in the 2Bt and 2C horizons ranges from 2 to 5 percent.

Stronghurst Series

The Stronghurst series consists of somewhat poorly drained, moderately permeable soils on glacial till plains. These soils formed in loess. Slopes range from 0 to 2 percent.

Typical pedon of Stronghurst silt loam, 275 feet east and 294 feet south of the center of sec. 24, T. 14 N., R. 9 E.

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak fine and medium granular structure; friable; common fine and medium roots; common fine concretions of iron and manganese oxide; neutral; clear smooth boundary.

E—8 to 12 inches; dark grayish brown (10YR 4/2) silt loam; few fine prominent yellowish brown (10YR 5/8) mottles; moderate medium platy structure parting to weak fine granular; friable; common fine and medium roots; common distinct white (10YR 8/2 dry) silt coatings on faces of peds; few fine concretions of iron and manganese oxide; neutral; abrupt smooth boundary.

Bt1—12 to 17 inches; brown (10YR 5/3) silty clay loam; common medium faint grayish brown (10YR 5/2) and few fine prominent yellowish brown (10YR 5/8) mottles; strong fine and medium subangular blocky structure; firm; common fine and medium roots; few distinct dark grayish brown (10YR 4/2) clay films and common distinct white (10YR 8/2 dry) silt coatings on faces of peds; common fine concretions of iron and manganese oxide; neutral; clear smooth boundary.

Bt2—17 to 24 inches; brown (10YR 5/3) silty clay loam; common medium faint grayish brown (10YR 5/2) and common fine prominent yellowish brown (10YR 5/8) mottles; moderate fine and medium prismatic structure parting to moderate fine and medium subangular blocky; firm; few fine and medium roots; common distinct dark grayish brown (10YR 4/2) clay films and common medium white (10YR 8/2 dry) silt coatings on faces of peds; few medium and common fine concretions of iron and manganese oxide; medium acid; clear smooth boundary.

Bt3—24 to 29 inches; grayish brown (10YR 5/2) silty clay loam; common fine and medium prominent yellowish brown (10YR 5/6 and 5/8) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; few fine and medium roots; common distinct dark grayish brown (10YR 4/2) clay films and few distinct white (10YR 8/2 dry) silt coatings on faces of peds; common fine concretions of iron and manganese oxide; medium acid; gradual smooth boundary.

Bt4—29 to 35 inches; grayish brown (10YR 5/2) silty clay loam; common fine and medium distinct yellowish brown (10YR 5/6) mottles; moderate

medium prismatic structure parting to moderate medium angular blocky; firm; few very fine and fine roots; common distinct dark grayish brown (10YR 4/2) and very dark grayish brown (10YR 3/2) clay films and very few distinct white (10YR 8/2 dry) silt coatings on faces of peds; many fine and medium concretions of iron and manganese oxide; slightly acid; gradual smooth boundary.

Bt5—35 to 44 inches; grayish brown (2.5Y 5/2) silty clay loam; common medium prominent yellowish brown (10YR 5/8) mottles; moderate medium prismatic structure; firm; few distinct very dark grayish brown (10YR 3/2) clay films in root channels; few distinct dark grayish brown (10YR 4/2) clay films and very few distinct white (10YR 8/2 dry) silt coatings on faces of peds; many fine and medium concretions of iron and manganese oxide; neutral; gradual smooth boundary.

BC—44 to 60 inches; grayish brown (2.5Y 5/2) silt loam; common medium prominent yellowish brown (10YR 5/8) mottles; weak coarse prismatic structure; friable; common fine and medium concretions of iron and manganese oxide; neutral.

The thickness of the solum ranges from 55 to 65 inches. The E horizon has value of 4 or 5. The Cg horizon, if it occurs, is silt loam.

Tama Series

The Tama series consists of moderately well drained, moderately permeable soils on glacial till plains. These soils formed in loess. Slopes range from 2 to 10 percent.

Typical pedon of Tama silt loam, 2 to 5 percent slopes, 780 feet north and 192 feet west of the southeast corner of sec. 3, T. 32 N., R. 1 W.

Ap—0 to 8 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; moderate fine granular structure; friable; common fine roots; slightly acid; abrupt smooth boundary.

A—8 to 11 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate medium granular structure; friable; common fine roots; medium acid; clear smooth boundary.

BA—11 to 14 inches; brown (10YR 4/3) silt loam; moderate medium and coarse granular structure; friable; common fine roots; common distinct very dark grayish brown (10YR 3/2) organic coatings on faces of peds; medium acid; clear smooth boundary.

Bt1—14 to 18 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate medium subangular blocky structure; friable; common fine roots; many distinct brown (10YR 4/3) clay films on faces of peds; medium acid; clear smooth boundary.

Bt2—18 to 24 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate medium subangular blocky structure; friable; few fine roots; many distinct brown (10YR 4/3) clay films on faces of peds; medium acid; clear smooth boundary.

Bt3—24 to 33 inches; dark yellowish brown (10YR 4/4) silty clay loam; few fine faint brown (10YR 5/3) and few fine distinct yellowish brown (10YR 5/6) mottles in the lower part; moderate medium subangular blocky structure; friable; few fine roots; common distinct brown (10YR 4/3) clay films on faces of peds; few fine accumulations of iron and manganese oxide; medium acid; clear smooth boundary.

Bt4—33 to 40 inches; dark yellowish brown (10YR 4/4) silt loam; few fine faint brown (10YR 5/3) and common fine distinct yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; friable; few fine roots; common distinct brown (10YR 4/3) clay films on faces of peds; common fine accumulations of iron and manganese oxide; slightly acid; clear smooth boundary.

Bt5—40 to 50 inches; dark yellowish brown (10YR 4/4) silt loam; common fine faint brown (10YR 5/3) and common fine distinct yellowish brown (10YR 5/6) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; friable; few fine roots; common distinct (10YR 4/3) clay films on faces of peds; common fine accumulations of iron and manganese oxide; neutral; clear smooth boundary.

BC—50 to 57 inches; dark yellowish brown (10YR 4/4) silt loam; few fine distinct grayish brown (10YR 5/2) and common fine distinct yellowish brown (10YR 5/6) mottles; weak medium prismatic structure; friable; few fine roots; few faint brown (10YR 4/3) clay films on faces of peds; common fine accumulations of iron and manganese oxide; neutral; clear smooth boundary.

C—57 to 60 inches; dark yellowish brown (10YR 4/4) silt loam; common fine distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/6) mottles; massive; friable; common fine accumulations of iron and manganese oxide; slight effervescence; mildly alkaline.

The thickness of the solum ranges from 43 to 65 inches. The depth to carbonates ranges from 45 to 60 inches. The mollic epipedon is 10 to 15 inches thick.

Tama silt loam, 5 to 10 percent slopes, eroded, has a

thinner dark surface layer than is definitive for the series. This difference, however, does not significantly affect the use or behavior of the soil.

Terril Series

The Terril series consists of well drained, moderately permeable soils on alluvial fans. These soils formed in alluvium. Slopes range from 1 to 7 percent.

Typical pedon of Terril loam, 1 to 7 percent slopes, 1,460 feet east and 2,300 feet north of the southwest corner of sec. 25, T. 33 N., R. 1 W.

Ap—0 to 9 inches; dark brown (10YR 3/3) loam, brown (10YR 5/3) dry; weak fine and medium granular structure; friable; common fine roots; about 3 percent of surface covered with pebbles and stones; neutral; clear smooth boundary.

A—9 to 30 inches; dark brown (10YR 3/3) loam, brown (10YR 5/3) dry; weak medium subangular blocky structure; friable; few fine roots; few distinct black (10YR 3/2) organic coatings on faces of peds; neutral; clear smooth boundary.

Bw1—30 to 46 inches; dark yellowish brown (10YR 4/4) loam; moderate medium subangular blocky structure; friable; few fine roots; many distinct very dark grayish brown (10YR 3/2) organic coatings on faces of peds; neutral; clear smooth boundary.

Bw2—46 to 60 inches; dark yellowish brown (10YR 4/4) loam; weak medium subangular blocky structure; friable; few very fine roots; common distinct dark brown (10YR 3/3) organic coatings on faces of peds; neutral.

The thickness of the solum ranges from 38 to 65 inches. The mollic epipedon is 24 to 32 inches thick. The C horizon, if it occurs, is loam or sandy loam.

Vanmeter Series

The Vanmeter series consists of moderately deep, moderately well drained, very slowly permeable soils on glacial till plains. These soils formed in material weathered from shale. Slopes range from 30 to 60 percent.

Typical pedon of Vanmeter silty clay loam, in an area of Hennepin-Vanmeter complex, 30 to 60 percent slopes; 940 feet west and 2,400 feet north of the southeast corner of sec. 26, T. 33 N., R. 1 W.

A—0 to 3 inches; dark grayish brown (10YR 4/2) silty clay loam, light brownish gray (10YR 6/2) dry; moderate medium granular structure; friable; many fine roots; slight effervescence; mildly alkaline; clear smooth boundary.

Bw1—3 to 7 inches; dark yellowish brown (10YR 4/4) silty clay; weak fine subangular blocky structure; friable; many fine roots; few faint dark yellowish brown (10YR 3/4) clay films on faces of peds; slight effervescence; mildly alkaline; clear smooth boundary.

Bw2—7 to 13 inches; light olive brown (2.5Y 5/4) clay; weak medium subangular blocky structure; firm; common fine roots; violent effervescence; moderately alkaline; clear smooth boundary.

Bw3—13 to 37 inches; olive gray (5Y 5/2) clay; weak medium subangular blocky structure; firm; violent effervescence; moderately alkaline; clear smooth boundary.

Cr—37 to 60 inches; olive gray (5Y 5/2) shale; violent effervescence; moderately alkaline.

The thickness of the solum ranges from 20 to 40 inches. Some pedons have a mantle of loess less than 15 inches thick.

The A horizon has value of 4 or 5. The Bw horizon has hue of 2.5Y, 10YR, 7.5YR, or 5YR, value of 4 to 6, and chroma of 2 to 6. The Cr horizon has hue of 5Y or 2.5Y, value of 4 to 6, and chroma of 2 to 4.

Varna Series

The Varna series consists of moderately well drained, slowly permeable soils on glacial till plains and moraines. These soils formed in glacial till. Slopes range from 2 to 10 percent.

The Varna soils in this county have a thinner dark surface layer than is definitive for the series. This difference, however, does not significantly affect the use or behavior of the soils.

Typical pedon of Varna silty clay loam, 5 to 10 percent slopes, eroded, 1,420 feet west and 360 feet north of the center of sec. 6, T. 32 N., R. 1 W.

Ap—0 to 9 inches; mixed very dark grayish brown (10YR 3/2) and dark yellowish brown (10YR 3/4) silty clay loam, grayish brown (10YR 5/2) and yellowish brown (10YR 5/4) dry; weak medium subangular blocky structure parting to weak medium granular; firm; common very fine and medium roots; few fine concretions of iron and manganese oxide; about 2 percent gravel; medium acid; abrupt smooth boundary.

Bt1—9 to 13 inches; dark yellowish brown (10YR 3/4) clay; moderate medium subangular blocky structure; firm; few very fine roots; common distinct dark brown (10YR 3/3) and few distinct very dark grayish brown (10YR 3/2) clay films on faces of peds; few fine concretions of iron and manganese oxide;

about 2 percent gravel; medium acid; clear smooth boundary.

Bt2—13 to 21 inches; dark yellowish brown (10YR 4/4) clay; strong medium angular blocky structure; firm; few very fine roots; many distinct olive brown (2.5Y 4/4) and few distinct very dark grayish brown (10YR 3/2) clay films on faces of peds; few fine concretions of iron and manganese oxide; about 2 percent gravel; slightly acid; clear smooth boundary.

Bt3—21 to 31 inches; olive brown (2.5Y 4/4) clay loam; common medium distinct grayish brown (2.5Y 5/2) mottles; strong coarse subangular blocky structure; firm; few very fine roots; few distinct very dark grayish brown (10YR 3/2) clay films on faces of peds; few fine accumulations of iron and manganese oxide; about 3 percent gravel; slight effervescence; mildly alkaline; clear smooth boundary.

C—31 to 60 inches; olive brown (2.5Y 4/4) clay loam; common medium distinct grayish brown (2.5Y 5/2) mottles; massive; firm; few very fine roots; few fine and medium concretions of iron and manganese oxide; many fine and medium secondary lime accumulations; about 3 percent gravel; strong effervescence; mildly alkaline.

The thickness of the solum ranges from 24 to 42 inches. The depth to carbonates ranges from 7 to 23 inches. Some pedons have a mantle of loess less than 15 inches thick.

The Ap horizon has value of 2 or 3 and chroma of 1 or 2. The Bt horizon has value of 4 or 5. It is silty clay loam, clay, or silty clay. The C horizon is clay loam, silty clay, or silty clay loam.

Wea Series

The Wea series consists of well drained soils on stream terraces. These soils formed in glacial outwash. Permeability is moderate in the upper part of the profile and very rapid in the lower part. Slopes range from 0 to 5 percent.

Typical pedon of Wea silt loam, 0 to 2 percent slopes, 1,260 feet west and 1,740 feet south of the center of sec. 10, T. 32 N., R. 2 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate fine and medium granular structure; friable; common very fine roots; neutral; clear smooth boundary.

A—7 to 15 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate medium granular structure; friable; common very fine roots; medium acid; clear smooth boundary.

Bt1—15 to 21 inches; brown (10YR 4/3) clay loam; weak medium prismatic structure parting to moderate medium subangular blocky; friable; common very fine roots; many distinct very dark grayish brown (10YR 3/2) clay films on faces of peds; medium acid; clear smooth boundary.

Bt2—21 to 28 inches; dark brown (7.5YR 4/4) clay loam; weak medium prismatic structure parting to weak medium subangular blocky; friable; few very fine roots; many distinct very dark grayish brown (10YR 3/2) clay films on faces of peds; about 2 percent gravel; medium acid; clear wavy boundary.

2Bt3—28 to 33 inches; dark brown (7.5YR 4/4) gravelly clay loam; weak coarse subangular blocky structure; friable; few very fine roots; many distinct very dark grayish brown (10YR 3/2) clay films on faces of peds and in root linings; about 33 percent gravel; neutral; abrupt irregular boundary.

2Bt4—33 to 43 inches; dark brown (7.5YR 4/4) very gravelly loam; weak coarse subangular blocky structure; friable; few very fine roots; many distinct dark yellowish brown (10YR 3/4) clay films on gravel surfaces; about 50 percent gravel; strong effervescence; mildly alkaline; gradual irregular boundary.

2C1—43 to 50 inches; dark brown (7.5YR 4/4) very gravelly sandy loam; massive; very friable; about 38 percent gravel; strong effervescence; mildly alkaline; gradual irregular boundary.

2C2—50 to 60 inches; brown (7.5YR 5/4) very gravelly loamy coarse sand; single grain; loose; about 40 percent gravel; strong effervescence; mildly alkaline.

The thickness of the solum and the depth to free carbonates range from 40 to 65 inches. The mollic epipedon ranges from 12 to 19 inches in thickness.

The Ap and A horizons have value of 2 or 3 and chroma of 1 or 2. Some pedons have a BA horizon. The Bt horizon has hue of 7.5YR or 10YR and value and chroma of 3 or 4. It commonly is clay loam, but some pedons have thin subhorizons of silty clay loam or sandy clay loam. The 2Bt horizon has hue of 10YR or 7.5YR, value of 4, and chroma of 3 or 4. It is clay loam, loam, or sandy clay loam and ranges from 15 to 60 percent gravel. In some pedons tongues of the 2Bt horizon extend several feet into the 2C horizon. The 2C horizon is sandy loam, coarse sandy loam, very coarse sandy loam, loamy sand, coarse loamy sand, very coarse loamy sand, sand, coarse sand, or very coarse sand and ranges from 15 to 60 percent gravel.

Worthen Series

The Worthen series consists of well drained, moderately permeable soils on alluvial fans. These soils formed in alluvium. Slopes range from 1 to 5 percent.

Typical pedon of Worthen silt loam, 1 to 5 percent slopes, 1,590 feet east and 1,440 feet north of the center of sec. 13, T. 14 N., R. 9 E.

Ap—0 to 8 inches; black (10YR 2/1) silt loam, dark gray (10YR 4/1) dry; weak fine and medium granular structure; friable; common fine roots; neutral; clear smooth boundary.

A1—8 to 13 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate fine and medium subangular blocky structure; friable; common very fine and fine roots; many distinct black (10YR 2/1) organic coatings on faces of peds; neutral; clear smooth boundary.

A2—13 to 24 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate fine prismatic structure parting to moderate medium subangular blocky; friable; common very fine and fine roots; neutral; gradual smooth boundary.

Bw1—24 to 34 inches; dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; moderate medium prismatic structure parting to moderate medium subangular blocky; friable; common very fine and fine roots; common distinct very dark grayish brown (10YR 3/2) organic coatings on faces of peds; neutral; gradual smooth boundary.

Bw2—34 to 47 inches; dark brown (10YR 3/3) silty clay loam, brown (10YR 5/3) dry; weak medium prismatic structure parting to weak medium subangular blocky; friable; common very fine and fine roots; common distinct very dark grayish brown (10YR 3/2) organic coatings on faces of peds; neutral; clear smooth boundary.

BC—47 to 57 inches; brown (7.5YR 4/4) loam; weak medium prismatic structure; friable; few very fine and fine roots; neutral; clear smooth boundary.

C—57 to 60 inches; dark yellowish brown (10YR 4/4) silt loam; massive; friable; strong effervescence; mildly alkaline.

The thickness of the solum and the depth to carbonates range from 50 to 60 inches. The mollic epipedon ranges from 30 to 50 inches in thickness.

The Ap and A horizons have chroma of 1 to 3. The Bw horizon has value of 3 to 5 and chroma of 3 or 4.

Formation of the Soils

In this section the major factors of soil formation and their degree of importance in the formation of the soils in the county are described.

Soil-forming processes act on deposited or accumulated geologic material. The characteristics of the soils at any given point are determined by the parent material, the plant and animal life on and in the soil, the climate, the relief, and the length of time that the forces of soil formation have acted on the soil material *(5)*.

Climate and plant and animal life, chiefly plants, are active factors of soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it into a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by relief. The parent material affects the kind of soil profile that forms and, in extreme cases, determines it almost entirely. Finally, time is needed for changing the parent material into a soil. Generally, a long time is required for the development of distinct horizons. The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the others.

Parent Material

Parent material is the unconsolidated mass in which a soil forms. The dominant parent materials in Putnam County are loess, glacial till, outwash, sandy eolian material, and alluvium. A few soils formed in residuum, or material weathered from bedrock. Some of these materials have been reworked and redeposited by subsequent actions of water and wind. Parent material determines the limits of the chemical and mineralogical composition of the soil. Although the parent materials in the county dominantly are of common glacial origin, their properties vary greatly, sometimes within small areas, depending on how the materials were deposited.

Loess, or wind-deposited silty material, is the most extensive parent material in Putnam County. The loess ranges from 8 to 12 feet in thickness on the stable, nearly level uplands. It was deposited about 22,000 to 12,500 years ago in the Woodfordian Substage of the Wisconsinan Glaciation. Fayette and Tama are examples of soils that formed in loess.

Glacial till is material laid down directly by glaciers with a minimum of water action. It is a mixture of particles of various sizes. It was deposited by the Illinoian and Wisconsinan glaciers. The more recent Wisconsinan glacier receded from the area about 14,000 years ago. The Wisconsinan glacial till blankets the Illinoian till in Putnam County. It forms a series of moraines that occur as ridges trending north to south and northwest to southwest. The glacial till was deposited by the Princeton and Peoria sublobes of the Lake Michigan lobe *(11)*. The types of glacial till in the county are the reddish brown Tiskilwa till and the younger Malden till. The glacial till is mantled by loess throughout most of the county. The moderately well drained Birkbeck and Catlin soils formed in loess and in the underlying Tiskilwa till, and the moderately well drained Morley and Varna soils formed in loess and in the underlying Malden till.

Outwash is material deposited by glacial meltwater. This material generally consists of layers of various particle sizes. Individual layers range from clay to gravel. The size of the particles in the layers varies with the velocity of the water that transported the material. The coarse particles, such as gravel and sand, were deposited as the water began to slow down. The finer particles, such as very fine sand, silt, and clay, were deposited in much slower or standing water. The well drained Dakota and Wea soils are examples of soils that formed in outwash.

Sandy eolian material is deposited as dunes by wind. The dunes are most extensive east of the Illinois River in the northwestern part of the county. Some of the dunes are adjacent to glacial till plains farther to the east and adjacent to stream terraces. The somewhat excessively drained Ade and Bloomfield soils are examples of soils that formed in sandy eolian material.

Alluvium is material recently deposited by floodwater of present streams. It varies in texture, depending on the speed of the floodwater. Sandy and gravelly materials were deposited by water flowing at a greater speed than that by which silty materials were deposited.

The well drained Lanier soils are examples of soils that formed in gravelly and sandy alluvium. The poorly drained Moundprairie soils are examples of soils that formed in silty alluvium.

The moderately well drained Vanmeter soils are examples of soils that formed in residuum derived from shale bedrock. This parent material is not extensive in Putnam County. It occurs only on deeply dissected side slopes in the glacial till plains.

Plant and Animal Life

Plants are the principal living organisms that have influenced the formation of the soils in Putnam County. Other organisms, however, such as bacteria, protozoa, earthworms, insects, and humans, have also been important. The chief contribution of plants and animals to soil formation is the addition of organic material to the soil. The amount and kind of organic matter on and in the soil depend on the kind of plants that grew on the soil. Native vegetation in the survey area was prairie grasses and deciduous hardwoods. Grasses have many fine, fibrous roots that add large amounts of organic matter to the upper part of the soil when they die and decay. The soils that formed under grasses, such as Tama and Catlin soils, generally have a surface layer that is very dark grayish brown or very dark brown. In soils that formed under forest vegetation, leaf litter contributes most of the organic matter to the surface layer. Soils that formed under deciduous trees, such as Fayette and Birkbeck soils, generally have a lighter colored surface layer that is lower in content of organic matter than the soils that formed under grasses.

Bacteria, fungi, and other micro-organisms help to break down the organic matter and thus provide nutrients for use by plants and other soil organisms. The stability of soil aggregates is affected by microbial activity. Cellular excretions from these organisms help to bind soil particles together. Stable aggregates help to maintain porosity and a favorable water-air relationship in the soil. Earthworms, crayfish, insects, and large burrowing animals incorporate organic matter into the soil and help to maintain porosity. The management of the soils by humans, which includes adding lime, fertilizers, herbicides, and pesticides and often results in accelerated erosion, influences soil formation. The soil properties and features identified in this soil survey provide the basic information necessary for good land management.

Relief

Relief, or topography, has markedly influenced the formation of the soils in Putnam County through its effects on natural drainage, erosion, plant cover, and soil temperature. Natural soil drainage ranges from excessively drained on the steep and very steep stream terrace escarpments to poorly drained in some nearly level areas of flood plains, glacial till plains, stream terraces, and outwash plains. Drainage, through its effect on aeration of the soil, determines the color of the soil. Runoff influences the amount of water that moves into the soil and thus affects the chemical and physical processes of soil formation. Surface runoff is greatest on the steeper slopes. Generally, soils that formed in similar parent material develop at a faster rate and to a greater depth on the more level slopes than on the steeper slopes. In low areas water is temporarily ponded. Water and air move freely through well drained soils but slowly through poorly drained soils. In well aerated soils the iron and aluminum compounds that give most soils their color are oxidized and brightly colored. Poorly aerated soils are dull gray and mottled. Fayette soils are an example of well aerated, well drained soils, and Sable soils are an example of poorly aerated, poorly drained soils.

Relief also greatly affects the rate of accelerated and geologic soil erosion. Soil erosion increases as the length of slope and the percent of slope increase.

Climate

Climate determines the kind of plant and animal life on and in the soil. It determines the amount of water available for the weathering of minerals and the translocation of soil material. Climate, through its influence on soil temperature, determines the rate of chemical reaction that occurs in the soil. These influences are important, but they affect large areas rather than a relatively small area, such as a county.

Putnam County has a temperate, humid, continental climate that is presumed to be similar to the climate under which the soils formed. The climate has favored the generally rapid weathering of soil material, the formation of clay, and the downward movement of clay through the profile. As a result of the translocation of clay, the subsoil in most upland soils in the county has more clay than the surface layer.

Time

Time, usually several thousand years, is necessary for the various processes of soil formation to act upon the parent material. Differences in length of time that the parent materials have been in place are commonly reflected in the degree of development of the soil profile. Some soils develop rapidly, while others form more slowly over a given period of time. The influence

of time is conditioned by erosion, deposition of materials, topography, and climate.

In general, soil formation occurs at a faster rate in permeable material that contains easily weatherable minerals with low amounts of calcium carbonate than in slowly permeable soil material that has high amounts of calcium carbonate. Soil formation proceeds at a faster rate under forest vegetation than under prairie vegetation because the water moving through the soil is more acid under forest vegetation and thus is more effective in leaching soluble bases. Soil formation is slower in strongly sloping areas than in nearly level areas because less water enters the soil and the resulting runoff encourages erosion of the surface layers.

The soils in Putnam County range in age from young to mature. For example, coarse textured soils, such as Ade soils, consist mostly of slowly weatherable quartz minerals that do not readily develop distinct soil horizons, even though they are readily leached of calcium carbonates and tend to be acid. These soils remain youthful over time. Soils that formed in recent alluvial sediments, such as Moundprairie soils, also remain youthful and show less profile development because of frequent deposits of alluvium. Soils that are intermediate in maturity, such as Stronghurst and Muscatine soils, are on relatively stable landscapes where deposition is negligible. These soils developed horizons in permeable, medium textured material (loess) over a relatively short period of time. Orio soils are an example of mature soils with distinct soil horizons. They have leached subsurface horizons and a high content of clay in the subsoil. They formed in depressions where runoff collects from surrounding slopes. The movement of this water through the soil accelerates the leaching of soluble minerals.

References

(1) American Association of State Highway and Transportation Officials. 1982. Standard specifications for highway materials and methods of sampling and testing. Ed. 13, 2 vols., illus.

(2) American Society for Testing and Materials. 1985. Standard test method for classification of soils for engineering purposes. ASTM Stand. D 2487.

(3) Fehrenbacher, J.B., R.A. Pope, I.J. Jansen, J.D. Alexander, and B.W. Ray. 1978. Soil productivity in Illinois. Univ. of Illinois, Coll. of Agric., Coop. Ext. Serv. Circ. 1156, 21 pp., illus.

(4) Illinois State Water Survey and Illinois State Geological Survey. 1975. Coal and water resources for coal conversion in Illinois. Illinois Coop. Resour. Rep. No. 4, 79 pp., illus.

(5) Jenny, Hans. 1941. Factors of soil formation. McGraw-Hill Book Company, Inc., 281 pp., illus.

(6) United States Department of Agriculture. 1951. Soil survey manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus.

(7) United States Department of Agriculture. 1961. Land capability classification. U.S. Dep. Agric. Handb. 210, 21 pp.

(8) United States Department of Agriculture. 1975. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. Soil Conserv. Serv., U.S. Dep. Agric. Handb. 436, 754 pp., illus.

(9) United States Department of Commerce, Bureau of the Census. 1984. 1982 census of agriculture—Illinois state and county data. Vol. 1, Part 13, 443 pp., illus.

(10) Wascher, H., R.S. Smith, and L.H. Smith. 1937. Putnam County soils. Illinois Agric. Exp. Stn. Soil Rep. No. 60, 30 pp., illus.

(11) Willman, H.B., and J.C. Frye. 1970. Pleistocene stratigraphy of Illinois. Illinois State Geol. Surv. Bull. 94, 204 pp., illus.

Glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly, such soil formed in recent alluvium or on steep rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Argillic horizon. A subsoil horizon characterized by an accumulation of illuvial clay.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation-exchange capacity.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bottom land. The normal flood plain of a stream, subject to flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles 2 millimeters to 38 centimeters (15 inches) long.

Coarse textured soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-

control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are:

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Dense layer (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly

pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, or clay.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 35 percent, by volume, rounded or angular rock fragments, not

prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric material.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake in inches per hour is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are:

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.

Mollic epipedon. A thick, dark, humus-rich surface horizon (or horizons) that has high base saturation and pedogenic soil structure. It may include the upper part of the subsoil.

Moraine (geology). An accumulation of earth, stones, and other debris deposited by a glacier. Some types are terminal, lateral, medial, and ground.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent.* The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium,* from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse,* more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water

through the soil, adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range in moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep-sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rippable. Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the substratum. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. it can also damage plant roots.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Med um sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the substratum. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to soil blowing and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Breaking up a compact subsoil by pulling a special chisel through the soil.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Till plain. An extensive flat to undulating area underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, are in soils in extremely small amounts. They are essential to plant growth.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

(Recorded in the period 1951-80 at Ottawa, Illinois)

Month	Temperature: Average daily maximum	Temperature: Average daily minimum	Temperature: Average	Temperature: 2 years in 10 will have-- Maximum temperature higher than--	Temperature: 2 years in 10 will have-- Minimum temperature lower than--	Temperature: Average number of growing degree days*	Precipitation: Average	Precipitation: 2 years in 10 will have-- Less than--	Precipitation: 2 years in 10 will have-- More than--	Precipitation: Average number of days with 0.10 inch or more	Precipitation: Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January-----	31.2	14.6	22.9	35	9	0	1.63	0.79	2.36	4	8.3
February----	36.7	19.4	28.1	41	15	1	1.38	.70	1.97	4	5.3
March-------	47.6	28.9	38.3	51	26	21	2.69	1.29	3.91	6	4.3
April-------	63.3	40.7	52.0	67	38	152	4.00	2.57	5.30	7	.7
May---------	74.5	50.8	62.7	78	47	407	3.46	2.10	4.68	6	.0
June--------	83.7	60.6	72.2	87	58	670	4.33	2.38	6.05	6	.0
July--------	86.6	64.5	75.6	89	63	801	4.07	2.29	5.65	6	.0
August------	85.0	62.7	73.9	87	61	746	3.53	1.67	5.14	6	.0
September---	78.7	54.9	66.9	81	52	513	3.34	1.19	5.12	5	.0
October-----	67.0	43.9	55.5	71	41	223	2.39	.77	3.72	5	.1
November----	50.4	32.3	41.4	54	31	39	1.88	1.05	2.61	4	1.9
December----	36.7	21.3	29.0	41	17	3	2.09	.92	3.08	5	7.4
Yearly:											
Average---	61.8	41.2	51.5	---	---	---	---	---	---	---	---
Extreme---	---	---	---	102	-21	---	---	---	---	---	---
Total-----	---	---	---	---	---	3,576	34.79	17.72	49.59	64	28.0

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50 degrees F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

(Recorded in the period 1951-80 at Ottawa, Illinois)

Probability	Temperature		
	24 °F or lower	28 °F or lower	32 °F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	Feb. 28	Mar. 21	Apr. 4
2 years in 10 later than--	Mar. 18	Mar. 29	Apr. 10
5 years in 10 later than--	Mar. 27	Apr. 9	Apr. 21
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 15	Oct. 4	Sept. 28
2 years in 10 earlier than--	Oct. 26	Oct. 19	Oct. 10
5 years in 10 earlier than--	Nov. 7	Nov. 1	Oct. 20

TABLE 3.--GROWING SEASON

(Recorded in the period 1951-80 at Ottawa, Illinois)

Probability	Daily minimum temperature during growing season		
	Higher than 24 °F	Higher than 28 °F	Higher than 32 °F
	Days	Days	Days
9 years in 10	202	178	161
8 years in 10	209	186	108
5 years in 10	224	202	180
2 years in 10	239	217	192
1 year in 10	247	225	199

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
23B	Blount silt loam, 1 to 5 percent slopes	355	0.3
25G	Hennepin loam, 30 to 60 percent slopes	4,345	3.9
27C2	Miami silt loam, 5 to 10 percent slopes, eroded	1,000	0.9
27D2	Miami loam, 10 to 18 percent slopes, eroded	1,075	1.0
27F	Miami loam, 18 to 30 percent slopes	1,825	1.7
36B	Tama silt loam, 2 to 5 percent slopes	9,875	9.0
36C2	Tama silt loam, 5 to 10 percent slopes, eroded	1,800	1.6
37B	Worthen silt loam, 1 to 5 percent slopes	590	0.5
41	Muscatine silt loam	12,295	11.4
53B	Bloomfield loamy fine sand, 1 to 7 percent slopes	530	0.5
53D	Bloomfield loamy fine sand, 7 to 20 percent slopes	480	0.4
67	Harpster silty clay loam	270	0.2
68	Sable silty clay loam	8,440	7.7
93B	Rodman gravelly loam, 2 to 7 percent slopes	160	0.1
93E	Rodman gravelly sandy loam, 12 to 30 percent slopes	375	0.3
93G	Rodman gravelly sandy loam, 30 to 60 percent slopes	975	0.9
98B	Ade loamy fine sand, 1 to 7 percent slopes	1,385	1.3
98D	Ade loamy fine sand, 7 to 15 percent slopes	560	0.5
131B2	Alvin fine sandy loam, 2 to 7 percent slopes, eroded	910	0.8
131D	Alvin fine sandy loam, 7 to 20 percent slopes	645	0.6
131F	Alvin fine sandy loam, 20 to 30 percent slopes	305	0.3
134B	Camden silt loam, 2 to 5 percent slopes	120	0.1
134C	Camden silt loam, 5 to 10 percent slopes	230	0.2
145C2	Saybrook silt loam, 5 to 10 percent slopes, eroded	260	0.2
151	Ridgeville fine sandy loam	390	0.4
154	Flanagan silt loam	2,185	2.0
171B	Catlin silt loam, 2 to 5 percent slopes	6,355	5.8
171C2	Catlin silt loam, 5 to 10 percent slopes, eroded	1,690	1.5
194C2	Morley silt loam, 5 to 10 percent slopes, eroded	465	0.4
194D2	Morley silty clay loam, 10 to 18 percent slopes, eroded	945	0.9
194F	Morley silt loam, 18 to 35 percent slopes	795	0.7
200	Orio fine sandy loam	125	0.1
205C	Metea loamy fine sand 5 to 10 percent slopes	360	0.3
205D	Metea loamy fine sand, 10 to 15 percent slopes	125	0.1
223B2	Varna silty clay loam, 2 to 5 percent slopes, eroded	230	0.2
223C2	Varna silty clay loam, 5 to 10 percent slopes, eroded	995	0.9
233B	Birkbeck silt loam, 2 to 5 percent slopes	2,230	2.0
233C2	Birkbeck silt loam, 5 to 10 percent slopes, eroded	1,355	1.2
236	Sabina silt loam	525	0.5
278	Stronghurst silt loam	560	0.5
279B	Rozetta silt loam, 2 to 5 percent slopes	4,300	3.9
280C2	Fayette silt loam, 5 to 10 percent slopes, eroded	2,235	2.0
359D	Fayette silt loam, till substratum, 10 to 15 percent slopes	565	0.5
379A	Dakota loam, 0 to 2 percent slopes	1,000	0.9
379B2	Dakota loam, 2 to 5 percent slopes, eroded	415	0.4
386B	Downs silt loam, 2 to 5 percent slopes	855	0.8
398A	Wea silt loam, 0 to 2 percent slopes	3,400	3.1
398B	Wea silt loam, 2 to 5 percent slopes	1,400	1.2
533	Urban land	270	0.2
536	Dumps, mine	85	0.1
552	Drummer silty clay loam, till substratum	975	0.9
570A	Martinsville loam, 0 to 2 percent slopes	725	0.7
570C	Martinsville fine sandy loam, 5 to 10 percent slopes	420	0.4
587B	Terril loam, 1 to 7 percent slopes	565	0.5
802B	Orthents, loamy, undulating	635	0.6
819G	Hennepin-Vanmeter complex, 30 to 60 percent slopes	395	0.4
865	Pits, gravel	90	0.1
1480	Moundprairie silty clay loam, wet	5,445	4.9
3480	Moundprairie silty clay loam, frequently flooded	1,540	1.4
7081	Littleton silt loam, rarely flooded	370	0.3
7107	Sawmill silty clay loam, rarely flooded	2,230	2.0
7302	Ambraw silty clay loam, rarely flooded	260	0.2
8077	Huntsville silt loam, occasionally flooded	1,310	1.2
8107	Sawmill silty clay loam, occasionally flooded	1,940	1.8

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
8304	Landes fine sandy loam, occasionally flooded	2,200	2.0
8378	Lanier gravelly sandy loam, occasionally flooded	180	0.2
	Water	8,195	7.4
	Total	110,135	100.0

TABLE 5.--PRIME FARMLAND

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name)

Map symbol	Soil name
23B	Blount silt loam, 1 to 5 percent slopes (where drained)
36B	Tama silt loam, 2 to 5 percent slopes
37B	Worthen silt loam, 1 to 5 percent slopes
41	Muscatine silt loam
67	Harpster silty clay loam (where drained)
68	Sable silty clay loam (where drained)
131B2	Alvin fine sandy loam, 2 to 7 percent slopes, eroded
134B	Camden silt loam, 2 to 5 percent slopes
151	Ridgeville fine sandy loam
154	Flanagan silt loam
171B	Catlin silt loam, 2 to 5 percent slopes
200	Orio fine sandy loam (where drained)
223B2	Varna silty clay loam, 2 to 5 percent slopes, eroded
233B	Birkbeck silt loam, 2 to 5 percent slopes
236	Sabina silt loam (where drained)
278	Stronghurst silt loam (where drained)
279B	Rozetta silt loam, 2 to 5 percent slopes
379A	Dakota loam, 0 to 2 percent slopes
379B2	Dakota loam, 2 to 5 percent slopes, eroded
386B	Downs silt loam, 2 to 5 percent slopes
398A	Wea silt loam, 0 to 2 percent slopes
398B	Wea silt loam, 2 to 5 percent slopes
552	Drummer silty clay loam, till substratum (where drained)
570A	Martinsville loam, 0 to 2 percent slopes
587B	Terril loam, 1 to 7 percent slopes
3480	Moundprairie silty clay loam, frequently flooded (where drained and either protected from flooding or not frequently flooded during the growing season)
7081	Littleton silt loam, rarely flooded
7107	Sawmill silty clay loam, rarely flooded (where drained)
7302	Ambraw silty clay loam, rarely flooded (where drained)
8077	Huntsville silt loam, occasionally flooded
8107	Sawmill silty clay loam, occasionally flooded (where drained)
8304	Landes fine sandy loam, occasionally flooded

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE

(Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Soil name and map symbol	Land capability	Corn	Soybeans	Winter wheat	Oats	Orchardgrass-alfalfa hay	Bromegrass-alfalfa
		Bu	Bu	Bu	Bu	Tons	AUM*
23B------------- Blount	IIe	105	35	47	63	4.3	7.0
25G------------- Hennepin	VIIe	---	---	---	---	---	2.1
27C2------------ Miami	IIIe	114	38	48	64	4.5	7.5
27D2------------ Miami	IVe	109	25	32	61	4.3	7.2
27F------------- Miami	VIe	---	---	---	---	---	6.5
36B------------- Tama	IIe	153	46	61	88	5.8	9.7
36C2------------ Tama	IIIe	146	43	58	84	5.5	9.2
37B------------- Worthen	IIe	149	46	61	87	5.8	9.7
41-------------- Muscatine	I	167	51	64	95	6.2	10.2
53B------------- Bloomfield	IIIs	79	31	41	51	3.1	5.3
53D------------- Bloomfield	IVe	73	29	38	47	3.0	4.8
67-------------- Harpster	IIw	136	44	52	74	---	---
68-------------- Sable	IIw	156	51	61	85	---	---
93B------------- Rodman	IVs	53	22	24	32	2.4	4.0
93E, 93G-------- Rodman	VIIs	---	---	---	---	---	---
98B------------- Ade	IIIs	90	31	41	56	3.6	6.1
98D------------- Ade	IIIe	85	29	38	53	3.4	5.7
131B2----------- Alvin	IIe	94	32	46	64	4.1	6.9
131D------------ Alvin	IIIe	90	30	44	58	4.0	6.6

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Winter wheat	Oats	Orchardgrass-alfalfa hay	Bromegrass-alfalfa
		Bu	Bu	Bu	Bu	Tons	AUM*
131F------------ Alvin	VIe	---	---	---	---	---	5.3
134B------------ Camden	IIe	124	39	54	71	5.0	8.2
134C------------ Camden	IIIe	121	38	53	70	4.9	8.1
145C2----------- Saybrook	IIIe	131	43	56	79	5.3	8.7
151------------- Ridgeville	IIs	115	40	53	75	4.6	7.7
154------------- Flanagan	I	162	52	67	92	6.1	10.2
171B------------ Catlin	IIe	149	46	60	86	5.7	9.6
171C2----------- Catlin	IIIe	141	43	57	82	5.5	9.1
194C2----------- Morley	IIIe	97	33	44	60	4.0	6.7
194D2----------- Morley	IVe	95	33	43	58	3.9	6.5
194F------------ Morley	VIe	---	---	---	---	---	5.0
200------------- Orio	IIw	112	37	47	64	---	---
205C------------ Metea	IIIe	97	33	43	59	3.8	6.3
205D------------ Metea	IVe	93	32	41	57	3.6	5.9
223B2----------- Varna	IIe	120	40	51	72	4.7	7.8
223C2----------- Varna	IIIe	110	39	50	71	4.5	7.5
233B------------ Birkbeck	IIe	122	41	54	69	4.9	8.2
233C2----------- Birkbeck	IIIe	116	38	52	66	4.7	7.8
236------------- Sabina	IIw	133	42	56	75	5.2	8.7
278------------- Stronghurst	IIw	138	42	55	76	5.3	9.3

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Winter wheat	Oats	Orchardgrass-alfalfa hay	Bromegrass-alfalfa
		Bu	Bu	Bu	Bu	Tons	AUM*
279B------------ Rozetta	IIe	130	40	53	72	5.1	8.6
280C2----------- Fayette	IIIe	121	37	50	69	4.9	8.1
359D------------ Fayette	IIIe	121	37	50	69	4.9	8.1
379A------------ Dakota	IIs	107	36	51	67	4.5	7.5
379B2----------- Dakota	IIe	103	35	49	65	4.3	7.2
386B------------ Downs	IIe	147	43	58	82	5.5	9.2
398A------------ Wea	I	120	47	61	80	5.5	9.1
398B------------ Wea	IIe	118	46	60	79	5.4	9.0
533**. Urban land							
536**. Dumps							
552------------- Drummer	IIw	154	51	61	83	---	---
570A------------ Martinsville	I	112	38	48	66	4.8	7.8
570C------------ Martinsville	IIIe	110	35	40	62	4.6	7.5
587B------------ Terril	IIe	145	46	58	101	5.0	8.3
802B. Orthents							
819G------------ Hennepin-Vanmeter	VIIe	---	---	---	---	---	---
865**. Pits							
1480------------ Moundprairie	Vw	---	---	---	---	---	---
3480------------ Moundprairie	IIIw	95	39	---	---	---	---
7081------------ Littleton	I	159	50	63	90	5.9	9.8

See footnotes at end of table.

TABLE 6.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Winter wheat	Oats	Orchardgrass-alfalfa hay	Bromegrass-alfalfa
		Bu	Bu	Bu	Bu	Tons	AUM*
7107------------ Sawmill	IIw	147	47	54	76	---	---
7302------------ Ambraw	IIw	132	43	52	70	---	---
8077------------ Huntsville	IIw	106	34	45	60	4.1	6.8
8107------------ Sawmill	IIw	147	47	54	76	---	---
8304------------ Landes	IIw	90	30	42	60	3.5	6.0
8378------------ Lanier	IIw	75	25	35	48	2.8	4.8

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.
** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--CAPABILITY CLASSES AND SUBCLASSES

(Miscellaneous areas are excluded. Absence of an entry indicates no acreage)

Class	Total acreage	Major management concerns (Subclass)		
		Erosion (e)	Wetness (w)	Soil problem (s)
		Acres	Acres	Acres
I	19,065	---	---	---
II	48,595	28,190	19,015	1,390
III	15,955	12,500	1,540	1,915
IV	2,785	2,625	---	160
V	5,445	---	5,445	---
VI	2,925	2,925	---	---
VII	6,090	4,740	---	1,350
VIII	---	---	---	---

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY

(Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available)

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Productivity class*	Trees to plant
25G------------- Hennepin	5R	Severe	Severe	Slight	Slight	Northern red oak---- White oak-----------	85 ---	5 ---	Northern red oak, white oak, green ash, black walnut, eastern white pine, red pine, eastern redcedar.
27C2, 27D2------ Miami	5A	Slight	Slight	Slight	Slight	White oak----------- Yellow poplar------- Sweetgum------------	90 98 76	5 7 5	Eastern white pine, red pine, white ash, yellow poplar, black walnut.
27F------------- Miami	5R	Moderate	Moderate	Slight	Slight	White oak----------- Yellow poplar------- Sweetgum------------	90 98 76	5 7 5	Eastern white pine, red pine, white ash, yellow poplar, black walnut.
53D------------- Bloomfield	4S	Slight	Slight	Moderate	Slight	Black oak----------- White oak----------- Scarlet oak--------- Shagbark hickory----	70 --- --- ---	4 --- --- ---	Eastern white pine, Scotch pine, red pine, eastern redcedar, jack pine.
93B------------- Rodman	4S	Slight	Slight	Severe	Slight	Northern red oak---- White oak----------- Red pine------------ Eastern white pine--	70 70 75 85	4 4 8 12	Eastern white pine, red pine, jack pine.
93E------------- Rodman	4R	Moderate	Moderate	Severe	Slight	Northern red oak---- White oak----------- Red pine------------ Eastern white pine--	70 70 75 85	4 4 8 12	Eastern white pine, red pine, jack pine.
93G------------- Rodman	4R	Severe	Severe	Severe	Slight	Northern red oak---- White oak----------- Red pine------------ Eastern white pine--	70 70 75 85	4 4 8 12	Eastern white pine, red pine, jack pine.
131D------------ Alvin	4A	Slight	Slight	Slight	Slight	White oak----------- Northern red oak---- Black walnut-------- Yellow poplar-------	80 80 --- 90	4 4 --- 6	Green ash, black walnut, yellow poplar, white oak, eastern white pine, American sycamore, sugar maple.

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Productivity class*	Trees to plant
131F------------ Alvin	4R	Moderate	Moderate	Slight	Slight	White oak-----------	80	4	Green ash, black walnut, yellow poplar, white oak, eastern white pine, American sycamore, sugar maple.
						Northern red oak----	80	4	
						Black walnut--------	---	---	
						Yellow poplar-------	90	6	
134C------------ Camden	7A	Slight	Slight	Slight	Slight	Yellow poplar-------	95	7	White oak, black walnut, green ash, eastern white pine, red pine, yellow poplar, black locust, white ash.
						White oak-----------	85	5	
						Northern red oak----	85	5	
						Sweetgum------------	80	6	
						Green ash-----------	76	5	
194C2, 194D2---- Morley	4A	Slight	Slight	Slight	Slight	White oak-----------	80	4	White oak, black walnut, green ash, eastern white pine, Norway spruce, red pine, white spruce.
						Northern red oak----	80	4	
						Yellow poplar-------	90	6	
						Black walnut--------	---	---	
						Bur oak-------------	---	---	
						Shagbark hickory----	---	---	
194F------------ Morley	4R	Moderate	Moderate	Slight	Slight	White oak-----------	80	4	White oak, black walnut, green ash, eastern white pine, Norway spruce, red pine, white spruce.
						Northern red oak----	80	4	
						Yellow poplar-------	90	6	
						Black walnut--------	---	---	
						Bur oak-------------	---	---	
						Shagbark hickory----	---	---	
205C, 205D------ Metea	4A	Slight	Slight	Slight	Slight	White oak-----------	80	4	Eastern white pine, red pine, yellow poplar, black walnut.
						Yellow poplar-------	86	6	
						Eastern white pine--	75	12	
						Red pine------------	75	10	
233B, 233C2----- Birkbeck	5A	Slight	Slight	Slight	Slight	White oak-----------	86	5	White oak, northern red oak, green ash, black walnut, eastern white pine, red pine, Scotch pine.
						Northern red oak----	---	---	
						Green ash-----------	---	---	

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordi-nation symbol	Management concerns: Erosion hazard	Management concerns: Equip-ment limita-tion	Management concerns: Seedling mortal-ity	Management concerns: Wind-throw hazard	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Produc-tivity class*	Trees to plant
236------------- Sabina	4A	Slight	Slight	Slight	Slight	White oak-----------	80	4	White oak, northern red oak, black walnut, eastern cottonwood, American sycamore, sugar maple, Scotch pine, eastern white pine.
						Northern red oak----	80	4	
						Black walnut--------	---	---	
278------------- Stronghurst	4A	Slight	Slight	Slight	Slight	White oak-----------	70	4	Eastern white pine, red pine, Scotch pine, eastern redcedar.
						Northern red oak----	70	4	
						Green ash-----------	---	---	
						Bur oak-------------	---	---	
279B------------ Rozetta	4A	Slight	Slight	Slight	Slight	White oak-----------	80	4	Eastern white pine, northern red oak, green ash, Scotch pine, yellow poplar.
						Northern red oak----	80	4	
						Yellow poplar-------	90	6	
						Black walnut--------	---	---	
280C2, 359D----- Fayette	4A	Slight	Slight	Slight	Slight	White oak-----------	80	4	Eastern white pine, northern red oak, green ash, yellow poplar.
						Northern red oak----	80	4	
						Yellow poplar-------	90	6	
						Black walnut--------	---	---	
386B------------ Downs	4A	Slight	Slight	Slight	Slight	White oak-----------	80	4	Eastern white pine, northern red oak, green ash, yellow poplar.
						Northern red oak----	80	4	
						Yellow poplar-------	90	6	
						Black walnut--------	---	---	
570C------------ Martinsville	4A	Slight	Slight	Slight	Slight	White oak-----------	80	4	Eastern white pine, red pine, white ash, yellow poplar, black walnut.
						Yellow poplar-------	98	7	
						Sweetgum------------	76	5	
819G**:									
Hennepin-------	5R	Severe	Severe	Slight	Slight	Northern red oak----	85	5	Northern red oak, white oak, green ash, black walnut, eastern white pine, red pine, eastern redcedar.
						White oak-----------	---	---	
Vanmeter-------	2R	Severe	Severe	Severe	Severe	White oak-----------	45	2	Eastern white pine, red pine.

See footnotes at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Potential productivity: Productivity class*	Trees to plant
1480, 3480 Moundprairie	2W	Slight	Severe	Slight	Slight	Green ash	50	2	Eastern cottonwood, green ash, silver maple.
						Eastern cottonwood	86	6	
8077 Huntsville	7A	Slight	Slight	Slight	Slight	Yellow poplar	98	7	Eastern cottonwood, black walnut, American sycamore, red maple, sugar maple, green ash, hackberry.
						Eastern cottonwood	110	11	
						American sycamore	---	---	
						Cherrybark oak	---	---	
						Sweetgum	---	---	
						Green ash	---	---	
8107 Sawmill	5W	Slight	Moderate	Moderate	Moderate	Pin oak	90	5	American sycamore, black spruce, hackberry, European larch, green ash, pin oak, red maple, swamp white oak.
						Eastern cottonwood	---	---	
						Sweetgum	---	---	
						Cherrybark oak	---	---	
						American sycamore	---	---	
8304 Landes	7A	Slight	Slight	Slight	Slight	Yellow poplar	95	7	Eastern cottonwood, yellow poplar, American sycamore, sweetgum, green ash, black walnut, eastern white pine, sugar maple.
						Eastern cottonwood	105	10	
						American sycamore	---	---	
						Sweetgum	---	---	
						Green ash	---	---	
8378 Lanier	4S	Slight	Slight	Moderate	Slight	Northern red oak	80	4	Eastern white pine, red pine, green ash.
						Black oak	80	4	
						Red maple	---	---	
						Bur oak	---	---	
						Quaking aspen	---	---	
						Green ash	---	---	
						Slippery elm	---	---	

* Productivity class is the yield in cubic meters per hectare per year calculated at the age of culmination of mean annual increment for fully stocked natural stands.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

(The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil)

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- 8-15	16-25	26-35	>35
23B. Blount	American cranberrybush, Amur honeysuckle, arrowwood, Amur privet, Washington hawthorn, eastern redcedar.	Osageorange, green ash, Austrian pine.	Pin oak, eastern white pine.	---
25G. Hennepin	Eastern redcedar, Osageorange, Russian olive, jack pine, Washington hawthorn, gray dogwood, silky dogwood, Amur privet, American cranberrybush.	Honeylocust, northern catalpa.	---	---
27C2, 27D2, 27F. Miami	Amur honeysuckle, Amur privet, American cranberrybush, silky dogwood.	White fir, blue spruce, northern whitecedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
36B, 36C2. Tama	American cranberrybush, Amur honeysuckle, Amur privet, silky dogwood.	Blue spruce, northern whitecedar, Washington hawthorn, white fir.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
37B. Worthen	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet.	Washington hawthorn, northern whitecedar, blue spruce, white fir.	Austrian pine, Norway spruce.	Pin oak, eastern white pine.
41. Muscatine	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern whitecedar, Washington hawthorn.	Norway spruce.	Eastern white pine, pin oak.
53B, 53D. Bloomfield	Radiant crabapple, eastern redcedar, autumn olive, Washington hawthorn, Amur honeysuckle, lilac.	Austrian pine, jack pine, red pine.	Eastern white pine.	---
67. Harpster	Nannyberry viburnum, Washington hawthorn.	White spruce, northern whitecedar, eastern redcedar, green ash, Osageorange.	Black willow.	---
68. Sable	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet.	Washington hawthorn, white fir, blue spruce, northern whitecedar, Austrian pine, Norway spruce.	Eastern white pine.	Pin oak.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- 8-15	16-25	26-35	>35
93B, 93E, 93G----- Rodman	Silky dogwood, gray dogwood, Amur honeysuckle, autumn olive, Washington hawthorn, radiant crabapple, eastern redcedar.	Black locust, jack pine, Virginia pine.	---	---
98B, 98D---------- Ade	Eastern redcedar, radiant crabapple, Washington hawthorn, autumn olive, Amur honeysuckle, lilac.	Austrian pine, jack pine, red pine.	Eastern white pine----	---
131B2, 131D, 131F- Alvin	Amur privet, Washington hawthorn, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, northern whitecedar, Osageorange, eastern redcedar.	Eastern white pine, red pine, Norway spruce.	---
134B, 134C-------- Camden	Amur honeysuckle, Amur privet, silky dogwood, American cranberrybush.	White fir, blue spruce, northern whitecedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
145C2------------- Saybrook	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	White fir, blue spruce, northern whitecedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
151--------------- Ridgeville	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern whitecedar, Washington hawthorn.	Norway spruce---------	Eastern white pine, pin oak.
154--------------- Flanagan	Amur honeysuckle, silky dogwood, Amur privet, American cranberrybush.	Austrian pine, white fir, blue spruce, northern whitecedar, Washington hawthorn.	Norway spruce---------	Eastern white pine, pin oak.
171B, 171C2------- Catlin	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet.	Washington hawthorn, northern whitecedar, blue spruce, white fir.	Austrian pine, Norway spruce.	Pin oak, eastern white pine.
194C2------------- Morley	American cranberrybush, silky dogwood, Amur honeysuckle, arrowwood, Amur privet, Washington hawthorn, eastern redcedar.	Osageorange, green ash, Austrian pine.	Pin oak, eastern white pine.	---

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- 8-15	16-25	26-35	>35
194D2, 194F: Morley	Amur honeysuckle, Washington hawthorn, eastern redcedar, Amur privet, arrowwood, American cranberrybush, silky dogwood.	Austrian pine, green ash, Osageorange.	Eastern white pine, pin oak.	---
200: Orio	American cranberrybush, Amur honeysuckle, Amur privet, silky dogwood.	Blue spruce, Norway spruce, northern whitecedar, Austrian pine, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
205C, 205D: Metea	Washington hawthorn, Amur honeysuckle, Amur privet, American cranberrybush.	Austrian pine, eastern redcedar, northern whitecedar, Osageorange.	Red pine, eastern white pine, Norway spruce.	---
223B2, 223C2: Varna	Eastern redcedar, Washington hawthorn, Amur honeysuckle, Amur privet, arrowwood, silky dogwood, American cranberrybush.	Austrian pine, green ash, Osageorange.	Eastern white pine, pin oak.	---
233B, 233C2: Birkbeck	Silky dogwood, Amur honeysuckle, Amur privet, American cranberrybush.	White fir, blue spruce, northern whitecedar, Washington hawthorn.	Norway spruce, Austrian pine.	Pin oak, eastern white pine.
236: Sabina	Silky dogwood, Amur honeysuckle, Amur privet, American cranberrybush.	Austrian pine, white fir, blue spruce, northern whitecedar, Washington hawthorn.	Norway spruce	Pin oak, eastern white pine.
278: Stronghurst	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern whitecedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
279B: Rozetta	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	White fir, blue spruce, northern whitecedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
280C2: Fayette	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	White fir, blue spruce, northern whitecedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
359D: Fayette	Redosier dogwood, Siberian peashrub, gray dogwood, lilac.	Northern whitecedar, hackberry, Russian olive, blue spruce, Amur maple, eastern redcedar.	Eastern white pine, green ash.	---
379A, 379B2: Dakota	Eastern redcedar, radiant crabapple, Washington hawthorn, autumn olive, Amur honeysuckle, lilac.	Eastern white pine, Austrian pine, red pine, jack pine.	---	---

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- 8-15	16-25	26-35	>35
386B Downs	American cranberrybush, Amur honeysuckle, autumn olive, silky dogwood.	Blue spruce, northern whitecedar, Washington hawthorn, white fir.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
398A, 398B Wea	Amur honeysuckle, American cranberrybush, Amur privet, silky dogwood.	White fir, northern whitecedar, blue spruce, Washington hawthorn.	Norway spruce, Austrian pine.	Pin oak, eastern white pine.
533*. Urban land				
536*. Dumps				
552 Drummer	Amur honeysuckle, American cranberrybush, Amur privet, silky dogwood.	Austrian pine, white fir, northern whitecedar, Washington hawthorn, Norway spruce, blue spruce.	Eastern white pine	Pin oak.
570A, 570C Martinsville	Amur honeysuckle, American cranberrybush, Amur privet, silky dogwood.	White fir, blue spruce, northern whitecedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
587B Terril	Gray dogwood, Siberian peashrub, redosier dogwood, lilac.	Honeylocust, Russian olive, Amur maple, blue spruce, northern whitecedar, eastern redcedar.	Eastern white pine, green ash.	---
802B. Orthents				
819G*: Hennepin	Eastern redcedar, Osageorange, Russian olive, jack pine, Washington hawthorn, gray dogwood, silky dogwood, Amur privet, American cranberrybush.	Honeylocust, northern catalpa.	---	---
Vanmeter	Eastern redcedar, Osageorange, Russian olive, Washington hawthorn.	Northern catalpa, honeylocust, green ash.	---	---
865*. Pits				

See footnote at end of table.

TABLE 9.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of-- 8-15	16-25	26-35	>35
1480, 3480-------- Moundprairie	Siberian peashrub, lilac, northern whitecedar.	Hackberry, white spruce, eastern redcedar, bur oak.	Golden willow, honeylocust, green ash.	Eastern cottonwood.
7081-------------- Littleton	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Eastern white pine, Austrian pine, white fir, blue spruce, northern whitecedar, Washington hawthorn.	Norway spruce---------	Pin oak.
7107-------------- Sawmill	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Norway spruce, Austrian pine, northern whitecedar, blue spruce, white fir, Washington hawthorn.	Eastern white pine----	Pin oak.
7302-------------- Ambraw	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	Norway spruce, Austrian pine, northern whitecedar, blue spruce, white fir, Washington hawthorn.	Eastern white pine----	Pin oak.
8077-------------- Huntsville	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern whitecedar, Washington hawthorn.	Norway spruce---------	Eastern white pine, pin oak.
8107-------------- Sawmill	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Norway spruce, Austrian pine, northern whitecedar, blue spruce, white fir, Washington hawthorn.	Eastern white pine----	Pin oak.
8304-------------- Landes	Silky dogwood, Amur privet, Amur honeysuckle, American cranberrybush.	Austrian pine, white fir, blue spruce, northern whitecedar, Washington hawthorn.	Norway spruce---------	Eastern white pine, pin oak.
8378-------------- Lanier	Siberian peashrub-----	Green ash, white spruce, Osageorange, eastern redcedar, nannyberry viburnum, northern whitecedar, Washington hawthorn.	Black willow----------	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--RECREATIONAL DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
23B------------------ Blount	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
25G------------------ Hennepin	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
27C2----------------- Miami	Moderate: percs slowly.	Moderate: percs slowly.	Severe: slope.	Slight----------	Slight.
27D2----------------- Miami	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
27F------------------ Miami	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
36B------------------ Tama	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
36C2----------------- Tama	Slight----------	Slight----------	Severe: slope.	Slight----------	Slight.
37B------------------ Worthen	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
41------------------- Muscatine	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Slight----------	Slight.
53B------------------ Bloomfield	Slight----------	Slight----------	Moderate: slope.	Slight----------	Moderate: droughty.
53D------------------ Bloomfield	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight----------	Moderate: droughty, slope.
67------------------- Harpster	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
68------------------- Sable	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
93B------------------ Rodman	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Slight----------	Severe: droughty.
93E------------------ Rodman	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.	Severe: droughty, slope.
93G------------------ Rodman	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: droughty, slope.
98B------------------ Ade	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Moderate: droughty.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
98D: Ade	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.	Moderate: droughty, slope.
131B2: Alvin	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
131D: Alvin	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: droughty, slope.
131F: Alvin	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
134B: Camden	Slight	Slight	Moderate: slope.	Slight	Slight.
134C: Camden	Slight	Slight	Severe: slope.	Slight	Slight.
145C2: Saybrook	Slight	Slight	Severe: slope.	Slight	Slight.
151: Ridgeville	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
154: Flanagan	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.
171B: Catlin	Slight	Slight	Moderate: slope.	Slight	Slight.
171C2: Catlin	Slight	Slight	Severe: slope.	Slight	Slight.
194C2: Morley	Moderate: percs slowly.	Moderate: percs slowly.	Severe: slope.	Slight	Slight.
194D2: Morley	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
194F: Morley	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
200: Orio	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
205C: Metea	Moderate: too sandy.	Moderate: too sandy.	Severe: slope.	Moderate: too sandy.	Moderate: droughty.
205D: Metea	Moderate: slope, too sandy.	Moderate: slope, too sandy.	Severe: slope.	Moderate: too sandy.	Moderate: droughty, slope.
223B2: Varna	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, small stones.	Slight	Moderate: large stones.
223C2: Varna	Moderate: percs slowly.	Moderate: percs slowly.	Severe: slope.	Slight	Moderate: large stones.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
233B------------------ Birkbeck	Slight----------	Slight----------	Moderate: slope.	Severe: erodes easily.	Slight.
233C2----------------- Birkbeck	Slight----------	Slight----------	Severe: slope.	Severe: erodes easily.	Slight.
236------------------- Sabina	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
278------------------- Stronghurst	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
279B------------------ Rozetta	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
280C2----------------- Fayette	Slight----------	Slight----------	Severe: slope.	Slight----------	Slight.
359D------------------ Fayette	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
379A------------------ Dakota	Slight----------	Slight----------	Moderate: small stones.	Slight----------	Slight.
379B2----------------- Dakota	Slight----------	Slight----------	Moderate: slope, small stones.	Slight----------	Slight.
386B------------------ Downs	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
398A------------------ Wea	Slight----------	Slight----------	Slight----------	Slight----------	Slight.
398B------------------ Wea	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
533*. Urban land					
536*. Dumps					
552------------------- Drummer	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
570A------------------ Martinsville	Slight----------	Slight----------	Moderate: small stones.	Slight----------	Slight.
570C------------------ Martinsville	Slight----------	Slight----------	Severe: slope.	Slight----------	Slight.
587B------------------ Terril	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
802B. Orthents					

See footnote at end of table.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
819G*:					
Hennepin	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Vanmeter	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Severe: slope, erodes easily.	Severe: slope.
865*. Pits					
1480, 3480 Moundprairie	Severe: flooding, wetness.	Moderate: flooding, wetness.	Severe: wetness, flooding.	Moderate: wetness, flooding.	Severe: flooding.
7081 Littleton	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
7107 Sawmill	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
7302 Ambraw	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
8077 Huntsville	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
8107 Sawmill	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
8304 Landes	Severe: flooding.	Slight	Slight	Slight	Moderate: small stones.
8378 Lanier	Severe: flooding.	Moderate: small stones.	Severe: small stones.	Slight	Severe: droughty.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--WILDLIFE HABITAT

(See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
23B---------------- Blount	Fair	Good	Good	Good	Poor	Very poor	Good	Good	Very poor.
25G---------------- Hennepin	Very poor	Poor	Good	Good	Very poor	Very poor	Poor	Good	Very poor.
27C2--------------- Miami	Fair	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor.
27D2, 27F---------- Miami	Poor	Fair	Good	Good	Very poor	Very poor	Fair	Good	Very poor.
36B---------------- Tama	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
36C2--------------- Tama	Fair	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor.
37B---------------- Worthen	Good	Good	Good	Good	Poor	Very poor	Good	Good	Very poor.
41----------------- Muscatine	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
53B, 53D----------- Bloomfield	Poor	Fair	Fair	Poor	Very poor	Very poor	Poor	Poor	Very poor.
67----------------- Harpster	Fair	Fair	Good	Fair	Good	Fair	Fair	Fair	Fair.
68----------------- Sable	Fair	Good	Good	Fair	Good	Good	Good	Fair	Good.
93B, 93E, 93G------ Rodman	Very poor	Poor	Fair	Poor	Very poor	Very poor	Poor	Poor	Very poor.
98B, 98D----------- Ade	Poor	Fair	Fair	Poor	Very poor	Very poor	Fair	Poor	Very poor.
131B2-------------- Alvin	Good	Good	Good	Good	Poor	Very poor	Good	Good	Very poor.
131D--------------- Alvin	Fair	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor.
131F--------------- Alvin	Poor	Fair	Good	Good	Very poor	Very poor	Fair	Good	Very poor.
134B--------------- Camden	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
134C--------------- Camden	Fair	Good	Good	Good	Poor	Very poor	Good	Good	Poor.
145C2-------------- Saybrook	Good	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba- ceous plants	Hardwood trees	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
151---------------- Ridgeville	Good	Good	Good	Good	Fair	Poor	Good	Good	Poor.
154---------------- Flanagan	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
171B--------------- Catlin	Good	Good	Good	Good	Poor	Very poor	Good	Good	Very poor.
171C2-------------- Catlin	Fair	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor.
194C2, 194D2------- Morley	Fair	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor.
194F--------------- Morley	Poor	Fair	Good	Good	Very poor	Very poor	Fair	Good	Very poor.
200---------------- Orio	Poor	Fair	Fair	Fair	Good	Fair	Fair	Fair	Fair.
205C--------------- Metea	Fair	Fair	Good	Good	Poor	Very poor	Fair	Good	Very poor.
205D--------------- Metea	Fair	Fair	Good	Good	Very poor	Very poor	Fair	Good	Very poor.
223B2-------------- Varna	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
223C2-------------- Varna	Fair	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor.
233B--------------- Birkbeck	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
233C2-------------- Birkbeck	Fair	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor.
236---------------- Sabina	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
278---------------- Stronghurst	Fair	Good	Good	Good	Fair	Fair	Good	Good	Fair.
279B--------------- Rozetta	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
280C2, 359D-------- Fayette	Fair	Good	Good	Good	Poor	Very poor	Good	Good	Very poor.
379A, 379B2-------- Dakota	Good	Good	Good	Good	Poor	Very poor	Good	Good	Very poor.
386B--------------- Downs	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
398A, 398B--------- Wea	Good	Good	Good	Good	Poor	Very poor	Good	Good	Very poor.

See footnote at end of table.

TABLE 11.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Woodland wildlife	Wetland wildlife
533*. Urban land									
536*. Dumps									
552---------------- Drummer	Fair	Good	Good	Fair	Good	Good	Good	Fair	Good.
570A--------------- Martinsville	Good	Good	Good	Good	Poor	Very poor	Good	Good	Very poor.
570C--------------- Martinsville	Fair	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor.
587B--------------- Terril	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
802B. Orthents									
819G*:									
Hennepin----------	Very poor	Poor	Good	Good	Very poor	Very poor	Poor	Good	Very poor.
Vanmeter----------	Very poor	Poor	Fair	Fair	Very poor	Very poor	Poor	Fair	Very poor.
865*. Pits									
1480, 3480--------- Moundprairie	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
7081--------------- Littleton	Fair	Good	Good	Good	Fair	Fair	Good	Good	Fair.
7107--------------- Sawmill	Good	Good	Good	Fair	Good	Fair	Good	Fair	Fair.
7302--------------- Ambraw	Good	Fair	Good	Good	Good	Good	Good	Good	Good.
8077--------------- Huntsville	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
8107--------------- Sawmill	Good	Good	Good	Fair	Good	Fair	Good	Fair	Fair.
8304--------------- Landes	Good	Good	Good	Good	Poor	Very poor	Good	Good	Very poor.
8378--------------- Lanier	Fair	Good	Good	Fair	Poor	Very poor	Good	Fair	Very poor.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--BUILDING SITE DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
23B: Blount	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
25G: Hennepin	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
27C2: Miami	Moderate: dense layer.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: low strength.	Slight.
27D2: Miami	Moderate: slope, dense layer.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
27F: Miami	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, low strength.	Severe: slope.
36B: Tama	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
36C2: Tama	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
37B: Worthen	Slight	Slight	Slight	Slight	Severe: low strength, frost action.	Slight.
41: Muscatine	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength, frost action.	Slight.
53B: Bloomfield	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Moderate: droughty.
53D: Bloomfield	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
67: Harpster	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
68: Sable	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
93B: Rodman	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Severe: droughty.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
93E, 93G---------- Rodman	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
98B--------------- Ade	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Slight---------	Moderate: droughty.
98D--------------- Ade	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: droughty, slope.
131B2------------- Alvin	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.	Moderate: droughty.
131D-------------- Alvin	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: droughty, slope.
131F-------------- Alvin	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
134B-------------- Camden	Slight---------	Moderate: shrink-swell.	Slight---------	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
134C-------------- Camden	Slight---------	Moderate: shrink-swell.	Slight---------	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
145C2------------- Saybrook	Moderate: wetness.	Slight---------	Moderate: wetness.	Moderate: slope.	Severe: frost action, low strength.	Slight.
151--------------- Ridgeville	Severe: cutbanks cave, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action.	Moderate: wetness.
154--------------- Flanagan	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell.	Severe: low strength, frost action, shrink-swell.	Moderate: wetness.
171B-------------- Catlin	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
171C2------------- Catlin	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
194C2------------- Morley	Moderate: too clayey, wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
194D2------------- Morley	Moderate: too clayey, slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
194F-------------- Morley	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
200 Orio	Severe: cutbanks cave, ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding, frost action.	Severe: ponding.
205C Metea	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Moderate: frost action.	Moderate: droughty.
205D Metea	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.	Moderate: droughty, slope.
223B2 Varna	Moderate: too clayey, wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Moderate: large stones.
223C2 Varna	Moderate: too clayey, wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Moderate: large stones.
233B Birkbeck	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
233C2 Birkbeck	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
236 Sabina	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength, frost action.	Moderate: wetness.
278 Stronghurst	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
279B Rozetta	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
280C2 Fayette	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: slope, shrink-swell.	Severe: frost action, low strength.	Slight.
359D Fayette	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
379A, 379B2 Dakota	Severe: cutbanks cave.	Slight	Slight	Slight	Moderate: low strength, frost action.	Slight.
386B Downs	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
398A, 398B Wea	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
533*. Urban land						

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
536*. Dumps						
552---------------Drummer	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: low strength, ponding, frost action.	Severe: ponding.
570A--------------Martinsville	Severe: cutbanks cave.	Moderate: shrink-swell.	Slight---------	Moderate: shrink-swell.	Moderate: frost action, shrink-swell.	Slight.
570C--------------Martinsville	Severe: cutbanks cave.	Moderate: shrink-swell.	Slight---------	Moderate: shrink-swell, slope.	Moderate: frost action, shrink-swell.	Slight.
587B--------------Terril	Slight---------	Slight---------	Slight---------	Moderate: slope.	Severe: low strength.	Slight.
802B. Orthents						
819G*:						
Hennepin---------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Vanmeter---------	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope.
865*. Pits						
1480, 3480--------Moundprairie	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, flooding, frost action.	Severe: flooding.
7081--------------Littleton	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, frost action.	Moderate: wetness.
7107--------------Sawmill	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness.	Severe: wetness.
7302--------------Ambraw	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness.	Severe: wetness.
8077--------------Huntsville	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding, frost action.	Moderate: flooding.

See footnote at end of table.

TABLE 12.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
8107: Sawmill	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.	Severe: wetness.
8304: Landes	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: small stones.
8378: Lanier	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: droughty.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--SANITARY FACILITIES

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "good," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
23B----------------- Blount	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
25G----------------- Hennepin	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
27C2---------------- Miami	Severe: percs slowly.	Severe: slope.	Slight-----------	Slight-----------	Good.
27D2---------------- Miami	Severe: percs slowly.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
27F----------------- Miami	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
36B----------------- Tama	Moderate: wetness.	Moderate: seepage, slope, wetness.	Severe: wetness.	Moderate: wetness.	Fair: too clayey.
36C2---------------- Tama	Moderate: wetness.	Severe: slope.	Severe: wetness.	Moderate: wetness.	Fair: too clayey.
37B----------------- Worthen	Slight-----------	Moderate: seepage, slope.	Slight-----------	Slight-----------	Good.
41------------------ Muscatine	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: wetness.
53B----------------- Bloomfield	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
53D----------------- Bloomfield	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
67------------------ Harpster	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
68------------------ Sable	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: hard to pack, ponding.
93B----------------- Rodman	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
93E, 93G------------ Rodman	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
98B Ade	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
98D Ade	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
131B2 Alvin	Slight	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage.
131D Alvin	Moderate: slope.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage.
131F Alvin	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, slope.
134B Camden	Slight	Moderate: seepage, slope.	Severe: seepage.	Slight	Fair: too clayey.
134C Camden	Slight	Severe: slope.	Severe: seepage.	Slight	Fair: too clayey.
145C2 Saybrook	Moderate: percs slowly, wetness.	Severe: slope.	Severe: wetness.	Moderate: wetness.	Fair: too clayey.
151 Ridgeville	Severe: wetness.	Severe: seepage, wetness.	Severe: seepage, wetness, too sandy.	Severe: wetness.	Poor: seepage, too sandy, wetness.
154 Flanagan	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: hard to pack.
171B Catlin	Severe: wetness.	Moderate: seepage, slope, wetness.	Severe: wetness.	Moderate: wetness.	Fair: too clayey.
171C2 Catlin	Severe: wetness.	Severe: slope.	Severe: wetness.	Moderate: wetness.	Fair: too clayey.
194C2 Morley	Severe: wetness, percs slowly.	Severe: slope.	Moderate: wetness, too clayey.	Slight	Fair: too clayey, wetness.
194D2 Morley	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.
194F Morley	Severe: percs slowly, slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: slope, too clayey, hard to pack.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
200---Orio	Severe: ponding, percs slowly.	Severe: seepage, ponding.	Severe: seepage, ponding, too sandy.	Severe: ponding.	Poor: seepage, too sandy, ponding.
205C, 205D---Metea	Severe: poor filter.	Severe: seepage, slope.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
223B2---Varna	Severe: wetness, percs slowly.	Severe: wetness.	Severe: too clayey.	Slight---	Poor: too clayey, hard to pack.
223C2---Varna	Severe: wetness, percs slowly.	Severe: slope, wetness.	Severe: too clayey.	Slight---	Poor: too clayey, hard to pack.
233B---Birkbeck	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
233C2---Birkbeck	Severe: wetness, percs slowly.	Severe: slope, wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
236---Sabina	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.
278---Stronghurst	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
279B---Rozetta	Moderate: wetness.	Moderate: seepage, slope, wetness.	Severe: wetness.	Moderate: wetness.	Fair: too clayey.
280C2---Fayette	Slight---	Severe: slope.	Moderate: too clayey.	Slight---	Fair: too clayey.
359D---Fayette	Moderate: slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
379A, 379B2---Dakota	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
386B---Downs	Moderate: wetness.	Moderate: seepage, slope, wetness.	Severe: wetness.	Moderate: wetness.	Fair: too clayey.
398A, 398B---Wea	Slight---	Severe: seepage.	Severe: seepage.	Slight---	Poor: small stones.
533*. Urban land					

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
536*. Dumps					
552 Drummer	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding.
570A Martinsville	Slight	Severe: seepage.	Severe: seepage.	Slight	Fair: thin layer.
570C Martinsville	Slight	Severe: seepage, slope.	Severe: seepage.	Slight	Fair: thin layer.
587B Terril	Slight	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
802B. Orthents					
819C*:					
Hennepin	Severe: percs slowly, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Vanmeter	Severe: thin layer, seepage, percs slowly.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: slope.	Poor: area reclaim, hard to pack, slope.
865*. Pits					
1480, 3480 Moundprairie	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
7081 Littleton	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
7107 Sawmill	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
7302 Ambraw	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
8077 Huntsville	Severe: flooding.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Good.
8107 Sawmill	Severe: flooding, wetness.	Severe: wetness, flooding.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
8304 Landes	Severe: flooding, poor filter.	Severe: seepage, flooding.	Severe: flooding, seepage, too sandy.	Severe: flooding, seepage.	Poor: seepage, too sandy.

See footnote at end of table.

TABLE 13.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
8378----------------- Lanier	Severe: flooding, poor filter.	Severe: seepage, flooding.	Severe: flooding, seepage, too sandy.	Severe: flooding, seepage.	Poor: seepage, too sandy, small stones.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--CONSTRUCTION MATERIALS

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
23B Blount	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
25G Hennepin	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
27C2 Miami	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, too clayey.
27D2 Miami	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, slope, too clayey.
27F Miami	Fair: slope, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
36B, 36C2 Tama	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
37B Worthen	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
41 Muscatine	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
53B Bloomfield	Good	Probable	Improbable: too sandy.	Fair: too sandy.
53D Bloomfield	Good	Probable	Improbable: too sandy.	Fair: too sandy, slope.
67 Harpster	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
68 Sable	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
93B Rodman	Good	Probable	Probable	Poor: area reclaim, small stones.
93E Rodman	Fair: slope.	Probable	Probable	Poor: area reclaim, small stones.
93G Rodman	Poor: slope.	Probable	Probable	Poor: area reclaim, small stones.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
98B: Ade	Good	Probable	Improbable: too sandy.	Fair: too sandy.
98D: Ade	Good	Probable	Improbable: too sandy.	Fair: too sandy, slope.
131B2, 131D: Alvin	Good	Probable	Improbable: too sandy.	Poor: too sandy.
131F: Alvin	Poor: slope.	Probable	Improbable: too sandy.	Poor: too sandy, slope.
134B, 134C: Camden	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
145C2: Saybrook	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
151: Ridgeville	Fair: wetness.	Probable	Improbable: too sandy.	Good.
154: Flanagan	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
171B, 171C2: Catlin	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
194C2, 194D2: Morley	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
194F: Morley	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, slope.
200: Orio	Poor: wetness.	Probable	Improbable: too sandy.	Poor: wetness.
205C, 205D: Metea	Good	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy.
223B2, 223C2: Varna	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
233B, 233C2: Birkbeck	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
236: Sabina	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
278: Stronghurst	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
279B: Rozetta	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
280C2: Fayette	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
359D: Fayette	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, slope.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
379A, 379B2 Dakota	Good	Probable	Probable	Poor: small stones, area reclaim.
386B Downs	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
398A, 398B Wea	Good	Probable	Probable	Poor: small stones, area reclaim.
533*. Urban land				
536*. Dumps				
552 Drummer	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
570A, 570C Martinsville	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
587B Terril	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
802B. Orthents				
819G*: Hennepin	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
Vanmeter	Poor: area reclaim, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope, too clayey.
865*. Pits				
1480, 3480 Moundprairie	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
7081 Littleton	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
7107 Sawmill	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
7302 Ambraw	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
8077 Huntsville	Good	Improbable: excess fines.	Improbable: excess fines.	Good.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
8107 Sawmill	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
8304 Landes	Good	Probable	Improbable: too sandy.	Fair: too sandy, small stones, thin layer.
8378 Lanier	Good	Probable	Probable	Poor: small stones, area reclaim.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--WATER MANAGEMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
23B Blount	Moderate: slope.	Moderate: piping, wetness.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, rooting depth.
25G Hennepin	Severe: slope.	Severe: piping.	Deep to water	Slope, rooting depth.	Slope	Slope, rooting depth.
27C2 Miami	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope, rooting depth.	Erodes easily	Erodes easily, rooting depth.
27D2, 27F Miami	Severe: slope.	Severe: piping.	Deep to water	Slope, rooting depth.	Slope, erodes easily.	Slope, erodes easily, rooting depth.
36B, 36C2 Tama	Moderate: seepage, slope.	Slight	Deep to water	Slope	Erodes easily	Erodes easily.
37B Worthen	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
41 Muscatine	Moderate: seepage.	Moderate: wetness.	Frost action	Wetness	Wetness, erodes easily.	Erodes easily.
53B Bloomfield	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty, rooting depth.
53D Bloomfield	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Slope, too sandy, soil blowing.	Slope, droughty, rooting depth.
67 Harpster	Moderate: seepage.	Severe: ponding, piping.	Ponding, frost action.	Ponding	Ponding	Wetness.
68 Sable	Moderate: seepage.	Severe: ponding.	Ponding, frost action.	Ponding	Ponding	Wetness.
93B Rodman	Severe: seepage.	Severe: seepage.	Deep to water	Slope, droughty.	Too sandy	Droughty.
93E, 93G Rodman	Severe: seepage, slope.	Severe: seepage.	Deep to water	Slope, droughty.	Slope, too sandy.	Slope, droughty.
98B Ade	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
98D Ade	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
131B2: Alvin	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope, droughty.	Soil blowing	Droughty, rooting depth.
131D, 131F: Alvin	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Slope, droughty.	Slope, soil blowing.	Slope, droughty, rooting depth.
134B, 134C: Camden	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope, erodes easily.	Erodes easily	Erodes easily.
145C2: Saybrook	Moderate: seepage, slope.	Moderate: piping.	Deep to water	Slope	Erodes easily	Erodes easily.
151: Ridgeville	Severe: seepage.	Severe: seepage, piping, wetness.	Frost action, cutbanks cave.	Wetness, soil blowing.	Wetness, too sandy, soil blowing.	Wetness.
154: Flanagan	Moderate: seepage.	Severe: wetness.	Frost action	Wetness	Erodes easily, wetness.	Erodes easily.
171B, 171C2: Catlin	Moderate: seepage, slope.	Moderate: wetness.	Deep to water	Slope	Erodes easily	Erodes easily.
194C2: Morley	Moderate: slope.	Slight	Deep to water	Percs slowly, slope, rooting depth.	Erodes easily	Erodes easily, rooting depth.
194D2, 194F: Morley	Severe: slope.	Moderate: hard to pack.	Deep to water	Slope, percs slowly.	Slope, erodes easily.	Slope, erodes easily, percs slowly.
200: Orio	Moderate: seepage.	Severe: seepage, piping, ponding.	Ponding, frost action, cutbanks cave.	Ponding, soil blowing.	Ponding, too sandy, soil blowing.	Wetness.
205C: Metea	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty, rooting depth.
205D: Metea	Severe: seepage, slope.	Severe: seepage, piping.	Deep to water	Slope, droughty, fast intake.	Slope, too sandy, soil blowing.	Slope, droughty, rooting depth.
223B2, 223C2: Varna	Moderate: slope.	Moderate: hard to pack.	Deep to water	Slope, percs slowly.	Erodes easily	Erodes easily.
233B, 233C2: Birkbeck	Moderate: seepage, slope.	Moderate: thin layer, piping, wetness.	Deep to water	Slope, erodes easily.	Erodes easily	Erodes easily.
236: Sabina	Slight	Severe: wetness.	Frost action	Wetness, erodes easily.	Erodes easily, wetness.	Erodes easily.
278: Stronghurst	Moderate: seepage.	Severe: wetness.	Frost action	Wetness, erodes easily.	Erodes easily, wetness.	Wetness, erodes easily.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
279B-------------- Rozetta	Moderate: seepage, slope.	Slight---------	Deep to water	Slope, erodes easily.	Erodes easily	Erodes easily.
280C2------------- Fayette	Moderate: slope, seepage.	Slight---------	Deep to water	Slope, erodes easily.	Erodes easily	Erodes easily.
359D-------------- Fayette	Severe: slope.	Slight---------	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
379A-------------- Dakota	Severe: seepage.	Severe: seepage, piping.	Deep to water	Favorable------	Too sandy------	Favorable.
379B2------------- Dakota	Severe: seepage.	Severe: seepage, piping.	Deep to water	Slope----------	Too sandy------	Favorable.
386B-------------- Downs	Moderate: seepage, slope.	Slight---------	Deep to water	Slope----------	Erodes easily	Erodes easily.
398A-------------- Wea	Severe: seepage.	Moderate: thin layer, piping.	Deep to water	Favorable------	Favorable------	Favorable.
398B-------------- Wea	Severe: seepage.	Moderate: thin layer, piping.	Deep to water	Slope----------	Favorable------	Favorable.
533*. Urban land						
536*. Dumps						
552--------------- Drummer	Moderate: seepage.	Severe: ponding.	Ponding, frost action.	Ponding--------	Ponding--------	Wetness.
570A-------------- Martinsville	Moderate: seepage.	Severe: piping.	Deep to water	Favorable------	Erodes easily	Erodes easily.
570C-------------- Martinsville	Moderate: seepage, slope.	Severe: piping.	Deep to water	Soil blowing, slope.	Erodes easily, soil blowing.	Erodes easily.
587B-------------- Terril	Moderate: seepage, slope.	Severe: piping.	Deep to water	Slope----------	Favorable------	Favorable.
802B. Orthents						
819G*: Hennepin---------	Severe: slope.	Severe: piping.	Deep to water	Slope, rooting depth.	Slope----------	Slope, rooting depth.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
819G*: Vanmeter	Severe: slope.	Severe: hard to pack.	Deep to water	Slope, percs slowly, thin layer.	Slope, area reclaim, erodes easily.	Slope, erodes easily, area reclaim.
865*. Pits						
1480, 3480 Moundprairie	Moderate: seepage.	Severe: piping, wetness.	Flooding, frost action.	Wetness, flooding.	Wetness	Wetness.
7081 Littleton	Moderate: seepage.	Severe: wetness, piping.	Frost action	Wetness	Erodes easily, wetness.	Wetness, erodes easily.
7107 Sawmill	Moderate: seepage.	Severe: wetness.	Frost action	Wetness	Wetness	Wetness.
7302 Ambraw	Moderate: seepage.	Severe: wetness, piping.	Frost action	Wetness	Wetness, erodes easily.	Wetness, erodes easily.
8077 Huntsville	Moderate: seepage.	Moderate: thin layer, piping.	Deep to water	Flooding	Favorable	Favorable.
8107 Sawmill	Moderate: seepage.	Severe: wetness.	Flooding, frost action.	Wetness, flooding.	Wetness	Wetness.
8304 Landes	Severe: seepage.	Severe: seepage, piping.	Deep to water	Favorable	Too sandy, soil blowing.	Favorable.
8378 Lanier	Severe: seepage.	Severe: seepage.	Deep to water	Droughty, flooding.	Too sandy	Droughty.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--ENGINEERING INDEX PROPERTIES

(The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated)

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
23B: Blount	0-10	Silt loam	CL	A-6, A-4	0-5	95-100	95-100	90-100	80-95	25-40	8-20
	10-26	Silty clay loam, silty clay, clay loam.	CH, CL	A-7, A-6	0-5	95-100	90-100	80-90	75-85	35-60	15-35
	26-40	Silty clay loam, clay loam.	CL, CH, ML, MH	A-6, A-7	0-5	95-100	90-100	80-90	70-90	35-55	10-30
	40-60	Silty clay loam, clay loam.	CL	A-6, A-7	0-10	90-100	90-100	80-100	70-90	30-45	10-25
25G: Hennepin	0-4	Loam	CL, CL-ML	A-4, A-6, A-7	0-5	90-100	85-100	70-100	60-95	25-45	5-20
	4-10	Loam, clay loam, silt loam.	SC, SM-SC, CL, CL-ML	A-4, A-6, A-7	0-5	85-100	75-100	65-100	35-95	20-50	5-25
	10-60	Loam, clay loam, silt loam.	SC, SM-SC, CL, CL-ML	A-4, A-6, A-7	0-5	85-100	75-100	65-100	35-95	20-50	5-25
27C2: Miami	0-7	Silt loam	CL, CL-ML, ML	A-4	0	100	95-100	80-100	50-90	15-30	3-10
	7-38	Clay loam, silty clay loam.	CL, SC	A-6	0	90-100	85-100	70-95	40-95	30-40	15-25
	38-60	Loam	CL, CL-ML, SC, SM-SC	A-4, A-6	0-3	85-100	85-100	70-90	45-70	20-40	5-20
27D2: Miami	0-7	Loam	CL, CL-ML, ML	A-4	0	100	95-100	80-100	50-90	15-30	3-10
	7-38	Clay loam, silty clay loam.	CL, SC	A-6	0	90-100	85-100	70-95	40-95	30-40	15-25
	38-60	Clay loam	CL, CL-ML, SC, SM-SC	A-4, A-6	0-3	85-100	85-100	70-90	45-70	20-40	5-20
27F: Miami	0-10	Loam	CL, CL-ML, ML	A-4	0	100	95-100	80-100	50-90	15-30	3-10
	10-32	Clay loam, silty clay loam.	CL, SC	A-6	0	90-100	85-100	70-95	40-95	30-40	15-25
	32-60	Loam	CL, CL-ML, SC, SM-SC	A-4, A-6	0-3	85-100	85-100	70-90	45-70	20-40	5-20
36B: Tama	0-14	Silt loam	ML, CL	A-6, A-7	0	100	100	100	95-100	35-45	10-20
	14-33	Silty clay loam	CL	A-7	0	100	100	100	95-100	40-50	15-25
	33-60	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
36C2: Tama	0-9	Silt loam	ML, CL	A-6, A-7	0	100	100	100	95-100	35-45	10-20
	9-30	Silty clay loam	CL	A-7	0	100	100	100	95-100	40-50	15-25
	30-60	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
37B: Worthen	0-24	Silt loam	CL	A-4, A-6	0	100	100	95-100	80-100	25-40	7-21
	24-60	Silt loam, silty clay loam, loam.	CL	A-4, A-6	0	100	100	95-100	80-100	25-40	7-21
41: Muscatine	0-17	Silt loam	CL, CL-ML	A-6, A-4	0	100	100	100	95-100	25-40	5-15
	17-52	Silty clay loam	CL	A-7	0	100	100	100	95-100	40-50	20-30
	52-60	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag-ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas-ticity index
	In				Pct					Pct	
53B, 53D--------- Bloomfield	0-4	Loamy fine sand	SM, SP, SP-SM	A-2-4, A-3	0	100	100	70-90	4-35	---	NP
	4-22	Fine sand, loamy fine sand, sand.	SP, SM, SP-SM	A-2-4, A-3	0	100	100	70-90	4-35	---	NP
	22-60	Fine sand, loamy fine sand, sand.	SM, SP, SP-SM	A-2-4, A-3	0	100	100	65-90	4-35	<20	NP-3
67--------------- Harpster	0-15	Silty clay loam	CL, CH	A-7	0	100	95-100	95-100	90-100	45-60	20-35
	15-23	Silty clay loam	CL, CH	A-7	0	100	95-100	95-100	85-100	40-60	20-35
	23-60	Silty clay loam, silt loam, loam.	CL, CH	A-6, A-7	0	100	95-100	95-100	70-100	35-55	20-35
68--------------- Sable	0-14	Silty clay loam	CL, CH, ML, MH	A-7	0	100	100	95-100	95-100	41-65	15-35
	14-47	Silty clay loam, silt loam.	CL, CH	A-7	0	100	100	95-100	95-100	40-55	20-35
	47-60	Silt loam, silty clay loam.	CL	A-6	0	100	100	95-100	95-100	30-40	10-20
93B-------------- Rodman	0-8	Gravelly loam----	ML, CL, SM, SC	A-4	0-2	70-85	65-75	60-75	36-65	<30	3-9
	8-14	Gravelly loam, sandy loam, loam.	ML, CL, SC, SM	A-4, A-2, A-1	0-2	70-85	60-85	40-75	20-55	<30	NP-10
	14-60	Stratified gravelly sand to extremely gravelly very coarse sand.	SP, SP-SM, GP, GP-GM	A-1	1-5	30-70	22-50	7-20	2-10	---	NP
93E, 93G--------- Rodman	0-6	Gravelly sandy loam.	SM-SC, SM, SP-SM	A-1, A-2	0-2	70-85	65-75	35-60	10-30	<25	NP-5
	6-19	Gravelly sandy loam, very gravelly sandy loam, loam.	ML, CL, SC, SM	A-4, A-2, A-1	0-2	70-85	60-85	40-75	20-55	<30	NP-10
	19-60	Stratified gravelly sand to extremely gravelly very coarse sand.	SP, SP-SM, GP, GP-GM	A-1	1-5	30-70	22-50	7-20	2-10	---	NP
98B, 98D--------- Ade	0-17	Loamy fine sand	SM, SP-SM	A-2-4	0	100	100	65-80	10-35	---	NP
	17-24	Fine sand, loamy fine sand.	SP, SM, SP-SM	A-3, A-2-4	0	100	100	65-80	3-15	---	NP
	24-60	Stratified fine sand to sandy loam.	SP, SM, SP-SM	A-3, A-2-4	0	100	100	65-80	3-15	---	NP
131B2------------ Alvin	0-8	Fine sandy loam	SM, ML	A-4, A-2	0	100	100	80-95	30-60	<25	NP-4
	8-31	Very fine sandy loam, sandy loam, loam.	SM, SC, CL, ML	A-2, A-4, A-6	0	100	100	70-100	20-80	15-40	NP-15
	31-60	Very fine sand, fine sandy loam, loamy fine sand.	SP, SP-SM, SM	A-2, A-3, A-1	0	95-100	90-100	45-95	4-35	<20	NP-4

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
131D, 131F------- Alvin	0-4	Fine sandy loam	SM, ML	A-4, A-2	0	100	100	80-95	30-60	<25	NP-4
	4-8	Fine sandy loam, sandy loam, loamy fine sand.	SM, ML	A-2, A-4	0	100	100	80-95	30-60	<25	NP-4
	8-35	Fine sandy loam, sandy loam, sandy clay, loam.	SM, SC, CL, ML	A-2, A-4, A-6	0	100	100	70-100	20-80	15-40	NP-15
	35-60	Very fine sand, sandy loam, loamy sand.	SP, SP-SM, SM	A-2, A-3, A-1	0	95-100	90-100	45-95	4-35	<20	NP-4
134B, 134C------- Camden	0-10	Silt loam--------	CL, ML, CL-ML	A-4, A-6	0	100	100	95-100	90-100	20-35	3-15
	10-33	Silt loam, silty clay loam.	CL	A-6	0	100	100	95-100	90-100	25-40	15-25
	33-60	Clay loam, sandy loam, loam.	ML, SC, SM, CL	A-2, A-4, A-6	0-5	90-100	85-100	60-100	30-70	20-40	3-15
145C2------------ Saybrook	0-8	Silt loam--------	CL, CL-ML	A-6, A-4	0	100	100	95-100	90-100	25-40	5-15
	8-25	Silty clay loam, silt loam.	CL, CH	A-7, A-6	0	95-100	95-100	90-100	85-100	35-55	15-30
	25-60	Loam, silt loam, clay loam.	CL	A-6, A-4	0	95-100	85-100	80-95	60-85	20-40	8-25
151-------------- Ridgeville	0-11	Fine sandy loam	SM, SM-SC	A-2, A-4	0	100	100	90-100	15-50	<25	NP-6
	11-27	Fine sandy loam, sandy clay loam, loam.	SM-SC, SC, CL, CL-ML	A-4, A-6	0	95-100	95-100	75-95	35-60	20-35	5-15
	27-60	Loamy fine sand, sandy loam, fine sand.	SM, SM-SC, SC, SP-SM	A-2, A-4	0	90-100	90-100	70-100	10-50	<20	NP-8
154-------------- Flanagan	0-17	Silt loam--------	CL	A-7, A-6	0	100	100	95-100	85-100	35-50	15-30
	17-54	Silty clay loam	CL, CH	A-7	0	100	100	95-100	85-100	40-60	15-30
	54-60	Loam, clay loam, silty clay loam.	CL, CL-ML	A-4, A-6, A-7	0	85-100	80-100	70-95	50-85	20-45	5-30
171B------------- Catlin	0-12	Silt loam--------	ML, CL, CL-ML	A-6, A-7	0	100	100	95-100	85-100	25-45	10-20
	12-51	Silty clay loam, silt loam.	CL	A-7, A-6	0	100	90-100	90-100	80-100	35-50	20-30
	51-60	Silt loam, clay loam, silty clay loam.	CL	A-6, A-7	0	90-100	90-100	85-100	60-100	25-45	10-20
171C2------------ Catlin	0-8	Silt loam--------	ML, CL, CL-ML	A-6, A-7	0	100	100	95-100	85-100	25-45	10-20
	8-41	Silty clay loam, silt loam.	CL	A-7, A-6	0	100	90-100	90-100	80-100	35-50	20-30
	41-60	Silt loam, clay loam, silty clay loam.	CL	A-6, A-7	0	90-100	90-100	85-100	60-100	25-45	10-20
194C2------------ Morley	0-7	Silt loam--------	CL, CL-ML	A-6, A-4	0-5	95-100	95-100	90-100	75-95	25-40	5-15
	7-26	Silty clay, clay loam, clay.	CL, CH	A-7	0-10	95-100	90-100	85-95	80-90	40-60	15-35
	26-36	Silty clay loam, clay loam, silty clay.	CL, CH	A-6, A-7	0-10	95-100	90-100	85-95	80-90	30-60	15-35
	36-60	Silty clay loam, clay loam.	CL	A-6, A-7	0-10	95-100	90-100	85-95	80-90	30-50	15-30

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
194D2------------ Morley	0-6	Silty clay loam	CL	A-6, A-7	0-5	95-100	90-100	85-95	80-90	30-45	15-25
	6-34	Silty clay loam, clay loam.	CL	A-6, A-7	0-10	95-100	90-100	85-95	80-90	30-50	15-30
	34-44	Silty clay loam, silty clay, clay.	CL, CH	A-6, A-7	0-10	95-100	90-100	85-95	80-90	30-60	15-35
	44-60	Silty clay loam, clay loam.	CL	A-6, A-7	0-10	95-100	90-100	85-95	80-90	30-50	15-30
194F------------- Morley	0-7	Silt loam--------	CL, CL-ML	A-6, A-4	0-5	95-100	95-100	90-100	75-95	25-40	5-15
	7-18	Silty clay loam, clay loam.	CL	A-6, A-7	0-10	95-100	90-100	85-95	80-90	30-50	15-30
	18-37	Silty clay loam, silty clay, clay.	CL, CH	A-6, A-7	0-10	95-100	90-100	85-95	80-90	30-60	15-35
	37-60	Silty clay loam, clay loam.	CL	A-6, A-7	0-10	95-100	90-100	85-95	80-90	30-50	15-30
200-------------- Orio	0-12	Fine sandy loam	SM, SC, SM-SC	A-4, A-2-4	0	100	100	70-85	25-50	15-30	2-10
	12-21	Loam, fine sandy loam, loamy sand.	SM, SC, ML, CL	A-4, A-2-4	0	100	100	75-90	15-60	<35	2-10
	21-42	Sandy loam, sandy clay loam, clay loam.	CL, SC	A-6, A-7	0	100	100	80-95	35-75	30-45	10-20
	42-60	Loamy fine sand, sand, fine sand.	SM, SC, SP-SM, SM-SC	A-2-4, A-3	0	100	100	60-90	5-35	20-30	NP-10
205C, 205D------- Metea	0-6	Loamy fine sand	SM	A-2-4	0	100	100	50-80	15-35	---	NP
	6-27	Loamy sand, loamy fine sand, fine sand.	SP-SM, SM	A-2-4, A-3	0	100	100	50-80	5-35	---	NP
	27-37	Sandy clay loam, fine sandy loam, sandy loam.	SC, SM-SC, CL, CL-ML	A-4, A-2-4	0	95-100	95-100	55-90	15-75	<27	4-9
	37-53	Loam, clay loam	CL	A-6	0-3	95-100	85-90	75-90	50-80	30-40	10-15
	53-60	Loam-------------	CL, CL-ML	A-4	0-3	85-95	75-95	65-90	50-75	<25	5-10
223B2, 223C2----- Varna	0-9	Silty clay loam	CL	A-6, A-7	0-10	95-100	85-100	85-100	80-95	30-50	12-25
	9-21	Silty clay, silty clay loam, clay.	CL, CH	A-7, A-6	0-10	95-100	85-100	85-100	80-100	35-56	15-29
	21-60	Silty clay loam, clay loam, silty clay.	CL	A-7, A-6	0-10	95-100	85-100	85-100	80-95	30-45	13-26
233B, 233C2------ Birkbeck	0-7	Silt loam--------	CL, ML	A-4, A-6, A-7	0	100	100	95-100	95-100	28-45	5-15
	7-47	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	95-100	95-100	85-100	30-50	10-25
	47-55	Loam, silty clay loam, clay loam.	CL, CL-ML	A-4, A-6	0-5	95-100	85-100	70-100	55-80	25-40	5-20
	55-60	Loam, clay loam	CL, CL-ML	A-4, A-6	0-5	95-100	85-100	70-100	55-80	20-40	5-20
236-------------- Sabina	0-14	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	95-100	90-100	25-40	5-15
	14-48	Silty clay loam, silty clay.	CL, CH	A-7	0	100	100	95-100	85-100	40-60	20-40
	48-60	Loam, clay loam, silty clay loam.	CL, CL-ML	A-4, A-6, A-7	0-5	95-100	85-100	70-100	55-75	20-50	5-30

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
278--------------- Stronghurst	0-8	Silt loam--------	CL, CL-ML, ML	A-4, A-6	0	100	100	95-100	95-100	25-35	5-15
	8-12	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	95-100	95-100	25-35	5-15
	12-44	Silty clay loam	CL, CH	A-7	0	100	100	100	98-100	40-55	20-35
	44-60	Silt loam--------	CL, CL-ML, ML	A-6, A-4	0	100	100	95-100	95-100	25-40	5-20
279B------------- Rozetta	0-9	Silt loam--------	CL	A-4, A-6	0	100	100	95-100	95-100	24-35	8-15
	9-35	Silty clay loam	CL	A-7, A-6	0	100	100	95-100	95-100	35-50	15-30
	35-60	Silt loam--------	CL	A-6, A-4	0	100	100	95-100	85-100	25-40	7-20
280C2------------ Fayette	0-6	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	6-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
359D------------- Fayette	0-6	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	100	95-100	25-40	4-15
	6-50	Silty clay loam	CL	A-6, A-7	0	100	100	100	95-100	35-45	15-25
	50-60	Loam-------------	CL, CL-ML	A-6, A-4	0-5	90-100	80-95	75-95	70-95	25-40	4-15
379A------------- Dakota	0-15	Loam, silt loam	CL	A-4, A-6	0	95-100	85-100	75-100	50-90	25-35	7-15
	15-31	Loam, sandy clay loam, clay loam.	CL, SC	A-4, A-6	0	95-100	85-100	70-100	35-80	25-40	9-20
	31-56	Sandy loam, loamy sand, gravelly loamy coarse sand.	SM, SP, GM, GP	A-2, A-4, A-1, A-3	0-5	55-100	45-100	20-75	2-40	<21	NP-4
	56-60	Sand, gravelly coarse sand, loamy sand.	SP, GP, GM, SM	A-1, A-3, A-2	0-5	50-100	45-100	20-75	2-30	---	NP
379B2------------ Dakota	0-9	Loam-------------	CL	A-4, A-6	0	95-100	85-100	75-100	50-90	25-35	7-15
	9-31	Loam, sandy clay loam, clay loam.	CL, SC	A-4, A-6	0	95-100	85-100	70-100	35-80	25-40	9-20
	31-35	Very gravelly sandy loam, gravelly clay loam, very gravelly loam.	SM, SP, GM, GP	A-2, A-4, A-1, A-3	0-5	55-100	45-100	20-75	2-40	<21	NP-4
	35-60	Very gravelly loamy coarse sand, loamy sand.	SP, GP, GM, SM	A-1, A-3, A-2	0-5	50-100	45-100	20-75	2-30	---	NP
386B------------- Downs	0-14	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	100	95-100	25-35	5-15
	14-37	Silty clay loam, silt loam.	CL	A-7, A-6	0	100	100	100	95-100	35-45	15-25
	37-60	Silt loam--------	CL	A-6	0	100	100	100	95-100	30-40	11-20
398A------------- Wea	0-15	Silt loam--------	CL, CL-ML, SC, SM-SC	A-4, A-6	0	95-100	90-100	45-100	45-100	20-30	4-13
	15-28	Silty clay loam, clay loam, loam.	CL	A-6	0	90-100	85-100	75-100	50-90	30-40	11-20
	28-50	Gravelly loam, gravelly sandy loam, gravelly sandy clay loam.	CL, SC	A-6, A-2	0-5	70-85	50-80	30-75	15-60	30-40	11-20
	50-60	Stratified gravelly loamy sand to very gravelly coarse sand.	SP, SP-SM, GP, GP-GM	A-1	1-5	30-70	30-70	10-40	1-10	---	NP

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
398B------------- Wea	0-14	Silt loam--------	CL, CL-ML, SC, SM-SC	A-4, A-6	0	95-100	90-100	45-100	45-100	20-30	4-13
	14-29	Silty clay loam, clay loam, loam.	CL	A-6	0	90-100	85-100	75-100	50-90	30-40	11-20
	29-60	Gravelly loam, gravelly sandy loam, gravelly sandy clay loam.	CL, SC	A-6, A-2	0-5	70-85	50-80	30-75	15-60	30-40	11-20
533*. Urban land											
536*. Dumps											
552-------------- Drummer	0-12	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	90-100	30-50	15-30
	12-50	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	90-100	30-50	15-30
	50-59	Silty clay loam, clay loam, loam.	CL	A-6	0	100	95-100	75-95	50-85	25-40	10-20
	59-65	Loam-------------	CL-ML, CL	A-4, A-6	0-5	95-100	85-100	75-95	55-80	20-30	6-15
570A------------- Martinsville	0-6	Loam-------------	CL, CL-ML, ML	A-4	0	100	85-100	75-100	65-90	<25	3-8
	6-23	Clay loam, silty clay loam, sandy clay loam.	CL, SC	A-4, A-6, A-2	0	95-100	85-100	70-100	30-95	25-40	7-15
	23-31	Sandy loam, loam, sandy clay loam.	SM-SC, CL-ML, CL, SC	A-2, A-4, A-6	0	95-100	85-100	55-95	30-75	20-30	5-11
	31-60	Stratified sand to silt loam.	SM, SM-SC, CL-ML	A-4, A-2-4, A-1	0	95-100	85-100	45-95	10-75	<25	NP-8
570C------------- Martinsville	0-5	Fine sandy loam	SM, SM-SC	A-4, A-2-4	0	100	85-100	55-85	30-50	<20	NP-6
	5-23	Clay loam, loam, sandy clay loam.	CL, SC	A-4, A-6, A-2	0	95-100	85-100	70-100	30-95	25-40	7-15
	23-56	Sandy loam, loam, sandy clay loam.	SM-SC, CL-ML, CL, SC	A-2, A-4, A-6	0	95-100	85-100	55-95	30-75	20-30	5-11
	56-60	Stratified sand to silt loam.	SM, SM-SC, CL-ML	A-4, A-2-4, A-1	0	95-100	85-100	45-95	10-75	<25	NP-8
587B------------- Terril	0-30	Loam-------------	CL	A-6	0-5	95-100	95-100	70-90	60-80	30-40	10-20
	30-60	Clay loam, loam, sandy loam.	CL, SC, SM-SC, CL-ML	A-6, A-4	0-5	95-100	90-100	65-95	35-85	20-40	5-20
802B. Orthents											
819G*: Hennepin--------	0-4	Loam-------------	CL, CL-ML	A-4, A-6, A-7	0-5	90-100	85-100	70-100	60-95	25-45	5-20
	4-60	Loam, clay loam, silt loam.	SC, SM-SC, CL, CL-ML	A-4, A-6, A-7	0-5	85-100	75-100	65-100	35-95	20-50	5-25

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
819G*:											
Vanmeter--------	0-3	Silty clay loam	ML, MH, CH	A-7	0-5	95-100	75-100	70-100	65-100	40-55	11-25
	3-37	Silty clay, clay	CH, CL	A-7	0-5	95-100	75-100	70-100	65-100	40-65	24-40
	37-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
865*. Pits											
1480------------- Moundprairie	0-13	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	80-100	35-50	12-25
	13-60	Silt loam, silty clay loam.	CL-ML, CL	A-4, A-6, A-7	0	100	100	90-100	85-95	22-50	7-25
3480------------- Moundprairie	0-9	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	80-100	35-50	12-25
	9-39	Silt loam, silty clay loam.	CL-ML, CL	A-4, A-6, A-7	0	100	100	90-100	85-95	22-50	7-25
	39-60	Silt loam, silty clay loam, loam.	CL-ML, CL	A-4, A-6, A-7	0	100	100	85-95	65-85	22-50	5-25
7081------------- Littleton	0-18	Silt loam--------	CL	A-4, A-6	0	100	100	95-100	90-100	25-40	7-20
	18-26	Silt loam--------	CL	A-4, A-6	0	100	100	95-100	90-100	25-40	7-20
	26-60	Silt loam--------	CL-ML, CL	A-4, A-6, A-7	0	100	100	95-100	80-100	20-45	5-20
7107------------- Sawmill	0-23	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	85-100	30-50	15-30
	23-32	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	85-100	30-50	15-30
	32-60	Silty clay loam, clay loam, silt loam.	CL	A-4, A-6, A-7	0	100	100	75-100	65-95	20-50	8-30
7302------------- Ambraw	0-16	Silty clay loam	CL	A-6, A-7	0	100	100	85-95	70-95	30-45	10-20
	16-36	Clay loam, clay	CL, CH	A-6, A-7	0	100	100	80-90	60-80	35-55	15-30
	36-46	Clay loam, sandy clay loam.	CL	A-7, A-6	0	100	90-100	85-95	50-85	30-50	10-25
	46-60	Stratified sandy clay loam to sandy loam.	SC, ML, CL, SM	A-6, A-4	0	100	90-100	80-90	40-80	20-40	NP-17
8077------------- Huntsville	0-32	Silt loam--------	CL	A-6	0	100	98-100	90-100	85-100	25-40	10-25
	32-60	Silt loam, loam, sandy loam.	CL, ML, SM, SC	A-4, A-6	0	90-100	80-100	55-95	45-85	20-35	NP-15
8107------------- Sawmill	0-25	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	85-100	30-50	15-30
	25-33	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	85-100	30-50	15-30
	33-60	Silty clay loam, clay loam, loam.	CL	A-6, A-7, A-4	0	100	100	85-100	70-95	25-50	8-25
8304------------- Landes	0-9	Fine sandy loam	SM, SC, SM-SC	A-4, A-2-4	0	100	70-100	70-95	20-50	<25	NP-10
	9-38	Loam, fine sandy loam, loamy fine sand.	SM, CL-ML, SC, SM-SC	A-4, A-2-4	0	100	85-100	70-100	15-60	<25	NP-10
	38-60	Fine sand, sandy loam.	SM, SP-SM, SC, SM-SC	A-4, A-2-4	0	100	85-100	70-85	10-50	<30	NP-10

See footnote at end of table.

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
8378------------- Lanier	0-7	Gravelly sandy loam.	SM, SC, SM-SC	A-2, A-1, A-4, A-6	0	75-90	60-80	35-70	20-45	<30	NP-12
	7-60	Stratified very gravelly coarse sand to gravelly sandy loam.	GW, SW, GP, SP	A-1	0-20	35-70	20-55	10-45	0-20	---	NP

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
23B--------------	0-10	22-27	1.35-1.55	0.6-2.0	0.20-0.24	5.1-7.3	Low----------	0.43	3	6	2-3
Blount	10-26	35-50	1.40-1.70	0.06-0.6	0.12-0.19	4.5-6.5	Moderate-----	0.43			
	26-40	27-38	1.50-1.70	0.06-0.6	0.12-0.19	6.1-7.8	Moderate-----	0.43			
	40-60	27-38	1.60-1.85	0.06-0.6	0.07-0.10	7.4-8.4	Moderate-----	0.43			
25G--------------	0-4	20-30	1.20-1.40	0.6-2.0	0.18-0.24	6.1-7.8	Low----------	0.32	3-2	6	1-2
Hennepin	4-10	18-30	1.30-1.60	0.2-0.6	0.14-0.22	6.1-8.4	Low----------	0.32			
	10-60	18-30	1.70-1.85	0.2-0.6	0.10-0.15	7.4-8.4	Low----------	0.32			
27C2, 27D2-------	0-7	11-22	1.30-1.45	0.6-2.0	0.20-0.24	5.6-7.3	Low----------	0.37	4	5	.5-3
Miami	7-38	27-35	1.45-1.65	0.6-2.0	0.15-0.20	5.1-6.0	Moderate-----	0.37			
	38-60	15-25	1.70-1.90	0.06-0.2	0.05-0.10	7.4-8.4	Moderate-----	0.37			
27F--------------	0-10	11-22	1.30-1.45	0.6-2.0	0.20-0.24	5.6-7.3	Low----------	0.37	4	5	.5-3
Miami	10-32	27-35	1.45-1.65	0.6-2.0	0.15-0.20	5.1-6.0	Moderate-----	0.37			
	32-60	15-25	1.70-1.90	0.06-0.2	0.05-0.10	7.4-8.4	Moderate-----	0.37			
36B--------------	0-14	20-26	1.25-1.30	0.6-2.0	0.22-0.24	5.1-7.3	Moderate-----	0.28	5	6	3-4
Tama	14-33	27-35	1.30-1.35	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.43			
	33-60	20-30	1.35-1.40	0.6-2.0	0.18-0.20	5.6-7.3	Moderate-----	0.43			
36C2-------------	0-9	20-26	1.25-1.30	0.6-2.0	0.22-0.24	5.1-7.3	Moderate-----	0.28	5	6	3-4
Tama	9-30	27-35	1.30-1.35	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.43			
	30-60	20-30	1.35-1.40	0.6-2.0	0.18-0.20	5.6-7.3	Moderate-----	0.43			
37B--------------	0-24	15-22	1.20-1.40	0.6-2.0	0.22-0.24	5.6-7.3	Low----------	0.32	5	6	3-4
Worthen	24-60	18-24	1.20-1.40	0.6-2.0	0.20-0.22	5.6-7.8	Low----------	0.43			
41---------------	0-17	24-27	1.28-1.32	0.6-2.0	0.22-0.24	5.1-7.3	Moderate-----	0.28	5	6	5-6
Muscatine	17-52	30-35	1.28-1.35	0.6-2.0	0.18-0.20	5.1-7.3	Moderate-----	0.43			
	52-60	22-30	1.35-1.40	0.6-2.0	0.18-0.20	6.6-7.8	Moderate-----	0.43			
53B, 53D---------	0-4	5-10	1.50-1.70	6.0-20	0.10-0.12	5.1-7.8	Low----------	0.15	5	2	.5-1
Bloomfield	4-22	2-10	1.60-1.80	6.0-20	0.06-0.11	5.1-7.3	Low----------	0.15			
	22-60	5-13	1.60-1.80	2.0-20	0.05-0.10	5.1-7.8	Low----------	0.15			
67---------------	0-15	27-35	1.05-1.25	0.6-2.0	0.21-0.24	7.4-8.4	Moderate-----	0.28	5	4L	5-6
Harpster	15-23	27-35	1.20-1.50	0.6-2.0	0.18-0.22	7.4-8.4	Moderate-----	0.28			
	23-60	22-35	1.25-1.55	0.6-2.0	0.17-0.22	7.4-8.4	Moderate-----	0.28			
68---------------	0-14	27-35	1.15-1.35	0.6-2.0	0.21-0.23	5.6-7.3	Moderate-----	0.28	5	7	5-6
Sable	14-47	24-35	1.30-1.50	0.6-2.0	0.18-0.20	5.6-7.8	Moderate-----	0.28			
	47-60	20-28	1.30-1.50	0.6-2.0	0.20-0.22	6.6-8.4	Low----------	0.28			
93B--------------	0-8	8-25	1.20-1.50	2.0-6.0	0.10-0.12	6.6-7.8	Low----------	0.20	3	8	2-4
Rodman	8-14	5-25	1.10-1.50	2.0-6.0	0.09-0.12	6.6-7.8	Low----------	0.20			
	14-60	0-10	1.60-1.70	>20	0.02-0.04	7.4-8.4	Low----------	0.10			
93E, 93G---------	0-6	5-20	1.10-1.40	2.0-6.0	0.09-0.12	6.6-7.8	Low----------	0.15	3	8	2-4
Rodman	6-19	5-25	1.10-1.50	2.0-6.0	0.09-0.12	6.6-8.4	Low----------	0.20			
	19-60	0-10	1.60-1.70	>20	0.02-0.04	7.4-8.4	Low----------	0.10			
98B, 98D---------	0-17	3-12	1.35-1.55	6.0-20	0.10-0.12	5.1-7.3	Low----------	0.17	5	2	2-4
Ade	17-24	3-12	1.40-1.60	6.0-20	0.06-0.08	5.1-7.3	Low----------	0.17			
	24-60	3-16	1.40-1.60	6.0-20	0.06-0.08	5.1-7.3	Low----------	0.17			

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
131B2------------	0-8	10-15	1.45-1.65	2.0-6.0	0.14-0.20	4.5-7.3	Low----------	0.24	5	3	.5-1
Alvin	8-31	15-18	1.45-1.65	0.6-6.0	0.12-0.20	4.5-6.0	Low----------	0.24			
	31-60	3-10	1.55-1.75	2.0-6.0	0.05-0.13	5.1-8.4	Low----------	0.24			
131D, 131F-------	0-4	10-15	1.45-1.65	2.0-6.0	0.14-0.20	4.5-7.3	Low----------	0.24	5	3	.5-1
Alvin	4-8	10-15	1.45-1.65	0.6-6.0	0.14-0.20	4.5-6.0	Low----------	0.24			
	8-35	15-18	1.45-1.65	0.6-6.0	0.12-0.20	4.5-6.0	Low----------	0.24			
	35-60	3-10	1.55-1.75	2.0-6.0	0.05-0.13	5.1-8.4	Low----------	0.24			
134B, 134C-------	0-10	14-27	1.15-1.35	0.6-2.0	0.22-0.24	5.1-7.3	Low----------	0.37	5	6	1-2
Camden	10-33	22-35	1.35-1.55	0.6-2.0	0.16-0.20	5.1-7.3	Moderate-----	0.37			
	33-60	18-30	1.45-1.65	0.6-2.0	0.11-0.22	5.1-7.3	Low----------	0.37			
145C2------------	0-8	20-26	1.10-1.30	0.6-2.0	0.22-0.24	5.6-7.3	Low----------	0.32	5	6	3-4
Saybrook	8-25	27-35	1.20-1.40	0.6-2.0	0.18-0.20	5.6-7.3	Moderate-----	0.43			
	25-60	24-35	1.50-1.70	0.6-2.0	0.15-0.21	5.6-8.4	Low----------	0.43			
151--------------	0-11	10-15	1.15-1.45	0.6-2.0	0.15-0.18	5.6-6.5	Low----------	0.20	5	3	2-4
Ridgeville	11-27	14-18	1.45-1.70	0.6-2.0	0.15-0.19	5.6-6.5	Low----------	0.20			
	27-60	3-10	1.55-1.90	2.0-6.0	0.09-0.13	6.1-7.8	Low----------	0.20			
154--------------	0-17	20-27	1.20-1.40	0.6-2.0	0.22-0.24	5.1-7.3	Moderate-----	0.28	5	6	4-5
Flanagan	17-54	35-42	1.25-1.45	0.6-2.0	0.15-0.22	5.6-7.3	High---------	0.43			
	54-60	20-30	1.45-1.70	0.2-0.6	0.15-0.22	6.1-8.4	Low----------	0.43			
171B-------------	0-12	18-27	1.15-1.40	0.6-2.0	0.22-0.24	5.1-7.3	Low----------	0.32	5	6	3-4
Catlin	12-51	27-35	1.25-1.55	0.6-2.0	0.18-0.20	5.1-7.3	Moderate-----	0.43			
	51-60	20-30	1.40-1.70	0.6-2.0	0.07-0.11	6.1-8.4	Low----------	0.43			
171C2------------	0-8	18-27	1.15-1.40	0.6-2.0	0.22-0.24	5.1-7.3	Low----------	0.32	5	6	3-4
Catlin	8-41	27-35	1.25-1.55	0.6-2.0	0.18-0.20	5.1-7.3	Moderate-----	0.43			
	41-60	20-30	1.40-1.70	0.6-2.0	0.07-0.11	6.1-8.4	Low----------	0.43			
194C2------------	0-7	22-27	1.35-1.55	0.6-2.0	0.20-0.24	5.1-7.3	Low----------	0.37	4	6	1-3
Morley	7-26	30-50	1.55-1.70	0.2-0.6	0.11-0.15	5.6-7.8	Moderate-----	0.32			
	26-36	27-50	1.60-1.80	0.06-0.6	0.07-0.12	6.1-8.4	Moderate-----	0.43			
	36-60	27-40	1.60-1.80	0.06-0.6	0.07-0.12	6.1-8.4	Moderate-----	0.43			
194D2------------	0-6	27-35	1.35-1.50	0.2-0.6	0.20-0.22	5.1-6.5	Moderate-----	0.37	4	7	1-2
Morley	6-34	27-40	1.45-1.65	0.2-0.6	0.18-0.20	5.1-6.5	Moderate-----	0.43			
	34-44	35-50	1.55-1.70	0.06-0.6	0.11-0.15	6.1-8.4	Moderate-----	0.43			
	44-60	27-40	1.60-1.80	0.06-0.6	0.07-0.12	6.1-8.4	Moderate-----	0.43			
194F-------------	0-7	22-27	1.35-1.55	0.6-2.0	0.20-0.24	5.1-6.5	Low----------	0.43	4	6	1-3
Morley	7-18	27-40	1.45-1.65	0.2-0.6	0.18-0.20	5.1-6.5	Moderate-----	0.43			
	18-37	35-50	1.55-1.70	0.06-0.6	0.11-0.15	6.1-8.4	Moderate-----	0.43			
	37-60	27-40	1.60-1.80	0.06-0.6	0.07-0.12	6.1-8.4	Moderate-----	0.43			
200--------------	0-12	8-18	1.30-1.50	2.0-6.0	0.13-0.15	4.5-7.8	Low----------	0.20	5	3	1-2
Orio	12-21	6-20	1.30-1.50	0.6-2.0	0.09-0.18	4.5-7.8	Low----------	0.28			
	21-42	18-30	1.40-1.60	0.2-0.6	0.12-0.19	4.5-7.8	Moderate-----	0.28			
	42-60	3-10	1.55-1.75	6.0-20	0.05-0.13	4.5-7.8	Low----------	0.28			
205C, 205D-------	0-6	3-8	1.55-1.65	6.0-20	0.10-0.12	5.6-7.3	Low----------	0.17	5	2	.5-1
Metea	6-27	2-10	1.65-1.80	6.0-20	0.06-0.11	5.1-6.5	Low----------	0.17			
	27-37	12-22	1.45-1.55	0.6-2.0	0.15-0.19	5.6-6.5	Low----------	0.32			
	37-53	24-35	1.45-1.65	0.6-2.0	0.15-0.19	5.6-7.3	Moderate-----	0.32			
	53-60	10-24	1.55-1.70	0.6-2.0	0.08-0.13	7.4-8.4	Low----------	0.32			

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
223B2, 223C2----- Varna	0-9	27-35	1.20-1.40	0.6-2.0	0.20-0.22	5.6-7.8	Moderate-----	0.32	4	7	1-2
	9-21	35-48	1.30-1.60	0.2-0.6	0.09-0.19	5.6-7.3	Moderate-----	0.37			
	21-60	27-40	1.50-1.70	0.06-0.6	0.12-0.18	6.6-8.4	Low----------	0.37			
233B, 233C2------ Birkbeck	0-7	15-27	1.20-1.40	0.6-2.0	0.22-0.24	5.1-7.3	Low----------	0.37	5	6	1-3
	7-47	25-35	1.30-1.50	0.6-2.0	0.18-0.22	4.5-7.3	Moderate-----	0.37			
	47-55	20-30	1.40-1.60	0.2-0.6	0.14-0.20	5.6-7.8	Low----------	0.37			
	55-60	17-30	1.55-1.90	0.2-0.6	0.05-0.19	6.6-8.4	Low----------	0.37			
236-------------- Sabina	0-14	20-27	1.25-1.45	0.6-2.0	0.22-0.24	5.1-7.3	Low----------	0.37	5	6	1-3
	14-48	35-42	1.35-1.55	0.2-0.6	0.11-0.20	5.6-7.3	High---------	0.37			
	48-60	15-32	1.50-1.80	0.2-0.6	0.11-0.18	7.4-8.4	Low----------	0.37			
278-------------- Stronghurst	0-8	20-27	1.25-1.45	0.6-2.0	0.22-0.24	5.1-7.3	Low----------	0.37	5	6	1-3
	8-12	20-27	1.30-1.50	0.6-2.0	0.20-0.22	5.1-7.3	Low----------	0.37			
	12-44	27-35	1.30-1.55	0.6-2.0	0.18-0.20	5.1-6.5	Moderate-----	0.37			
	44-60	20-27	1.35-1.60	0.6-2.0	0.20-0.22	5.6-7.3	Low----------	0.37			
279B------------- Rozetta	0-9	15-27	1.20-1.40	0.6-2.0	0.22-0.24	5.1-7.3	Low----------	0.37	5	6	1-3
	9-35	27-35	1.35-1.55	0.6-2.0	0.18-0.22	4.5-6.0	Moderate-----	0.37			
	35-60	20-27	1.40-1.60	0.6-2.0	0.20-0.22	5.6-7.8	Low----------	0.37			
280C2------------ Fayette	0-6	15-25	1.30-1.35	0.6-2.0	0.20-0.22	5.1-7.3	Low----------	0.37	5	6	1-2
	6-60	25-35	1.30-1.45	0.6-2.0	0.18-0.20	4.5-6.0	Moderate-----	0.37			
359D------------- Fayette	0-6	15-27	1.30-1.35	0.6-2.0	0.22-0.24	5.1-7.3	Low----------	0.37	5	6	1-2
	6-50	27-35	1.30-1.45	0.6-2.0	0.18-0.20	4.5-6.5	Moderate-----	0.37			
	50-60	15-27	1.45-1.60	0.6-2.0	0.17-0.19	6.6-7.8	Low----------	0.37			
379A------------- Dakota	0-15	14-27	1.40-1.50	0.6-2.0	0.19-0.24	5.1-7.3	Low----------	0.24	4	5	2-5
	15-31	18-32	1.30-1.55	0.6-2.0	0.15-0.19	5.1-7.3	Low----------	0.32			
	31-56	4-11	1.55-1.65	2.0-6.0	0.02-0.14	5.1-7.3	Low----------	0.24			
	56-60	1-4	1.55-1.65	6.0-20	0.02-0.10	5.1-7.8	Low----------	0.15			
379B2------------ Dakota	0-9	14-27	1.40-1.50	0.6-2.0	0.19-0.24	5.1-7.3	Low----------	0.24	4	5	2-4
	9-31	18-32	1.30-1.55	0.6-2.0	0.15-0.19	5.1-7.3	Low----------	0.32			
	31-35	4-11	1.55-1.65	2.0-6.0	0.02-0.14	5.1-7.3	Low----------	0.24			
	35-60	1-4	1.55-1.65	6.0-20	0.02-0.10	5.1-7.8	Low----------	0.15			
386B------------- Downs	0-14	15-25	1.25-1.30	2.0-6.0	0.21-0.23	5.1-7.3	Low----------	0.32	5	6	2-3
	14-37	26-35	1.30-1.35	0.6-2.0	0.18-0.20	5.1-7.3	Moderate-----	0.43			
	37-60	18-27	1.35-1.45	0.6-2.0	0.18-0.20	5.6-7.8	Moderate-----	0.43			
398A------------- Wea	0-15	12-22	1.30-1.45	0.6-2.0	0.20-0.24	5.6-7.3	Low----------	0.32	5	5	2-5
	15-28	20-32	1.40-1.60	0.6-2.0	0.15-0.20	5.1-6.5	Moderate-----	0.32			
	28-50	18-30	1.50-1.70	0.6-2.0	0.06-0.10	5.6-7.8	Moderate-----	0.24			
	50-60	1-5	1.60-1.80	>20	0.02-0.04	7.4-8.4	Low----------	0.10			
398B------------- Wea	0-14	12-22	1.30-1.45	0.6-2.0	0.20-0.24	5.6-7.3	Low----------	0.32	5	5	2-5
	14-29	20-32	1.40-1.60	0.6-2.0	0.15-0.20	5.1-6.5	Moderate-----	0.32			
	29-60	18-30	1.50-1.70	0.6-2.0	0.06-0.10	5.6-7.3	Moderate-----	0.24			
533*. Urban land											
536*. Dumps											

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
552------------- Drummer	0-12	27-35	1.40-1.60	0.6-2.0	0.21-0.23	6.1-7.3	Moderate-----	0.28	5	7	5-6
	12-50	27-35	1.40-1.60	0.6-2.0	0.18-0.20	6.1-7.3	Moderate-----	0.28			
	50-59	22-30	1.45-1.65	0.6-2.0	0.17-0.22	6.6-7.8	Moderate-----	0.28			
	59-65	15-27	1.70-1.80	0.2-0.6	0.05-0.12	7.9-8.4	Low----------	0.28			
570A------------- Martinsville	0-6	8-20	1.30-1.45	0.6-2.0	0.20-0.24	5.1-7.3	Low----------	0.37	5	5	1-2
	6-23	20-33	1.40-1.60	0.6-2.0	0.16-0.20	5.1-6.5	Moderate-----	0.37			
	23-31	15-25	1.40-1.60	0.6-2.0	0.12-0.17	5.1-6.5	Low----------	0.24			
	31-60	2-20	1.50-1.70	0.6-6.0	0.08-0.17	5.6-8.4	Low----------	0.24			
570C------------- Martinsville	0-5	5-15	1.35-1.50	2.0-6.0	0.13-0.18	5.1-7.3	Low----------	0.24	5	3	1-2
	5-23	20-33	1.40-1.60	0.6-2.0	0.16-0.20	5.1-6.5	Moderate-----	0.37			
	23-56	15-25	1.40-1.60	0.6-2.0	0.12-0.17	5.1-6.5	Low----------	0.24			
	56-60	2-20	1.50-1.70	0.6-6.0	0.08-0.17	5.6-8.4	Low----------	0.24			
587B------------- Terril	0-30	18-26	1.35-1.40	0.6-2.0	0.20-0.22	6.1-7.3	Low----------	0.24	5	6	4-5
	30-60	15-30	1.45-1.70	0.6-2.0	0.16-0.18	6.1-7.8	Low----------	0.32			
802B. Orthents											
819G*:											
Hennepin--------	0-4	20-30	1.20-1.40	0.6-2.0	0.18-0.24	6.1-7.8	Low----------	0.32	3-2	6	1-2
	4-60	18-30	1.70-1.85	0.2-0.6	0.10-0.15	7.4-8.4	Low----------	0.32			
Vanmeter--------	0-3	27-35	1.30-1.40	0.2-0.6	0.14-0.16	6.1-8.4	Moderate-----	0.43	3	7	1-2
	3-37	40-60	1.50-1.60	<0.06	0.12-0.14	6.1-8.4	High---------	0.32			
	37-60	---	---	---	---	---	-------------	----			
865*. Pits											
1480------------- Moundprairie	0-13	28-35	1.30-1.40	0.6-2.0	0.18-0.22	7.4-7.8	Moderate-----	0.32	5	4L	2-3
	13-60	18-35	1.35-1.45	0.6-2.0	0.18-0.22	7.4-7.8	Moderate-----	0.32			
3480------------- Moundprairie	0-9	28-35	1.30-1.40	0.6-2.0	0.18-0.22	7.4-8.4	Moderate-----	0.32	5	4L	2-3
	9-39	18-35	1.35-1.45	0.6-2.0	0.18-0.22	7.4-7.8	Moderate-----	0.32			
	39-60	15-35	1.35-1.50	0.6-2.0	0.16-0.22	6.6-7.8	Moderate-----	0.32			
7081------------- Littleton	0-18	18-27	1.20-1.45	0.6-2.0	0.20-0.24	5.6-7.8	Low----------	0.32	5	6	3-4
	18-26	22-27	1.20-1.40	0.6-2.0	0.22-0.24	5.6-7.8	Low----------	0.32			
	26-60	18-27	1.20-1.40	0.6-2.0	0.20-0.22	5.6-7.8	Low----------	0.43			
7107------------- Sawmill	0-23	27-35	1.20-1.40	0.6-2.0	0.21-0.23	6.1-7.8	Moderate-----	0.28	5	7	4-5
	23-32	27-35	1.20-1.40	0.6-2.0	0.21-0.23	6.1-7.8	Moderate-----	0.28			
	32-60	18-35	1.35-1.50	0.6-2.0	0.15-0.19	6.1-8.4	Moderate-----	0.28			
7302------------- Ambraw	0-16	27-35	1.40-1.60	0.6-2.0	0.20-0.23	5.6-7.3	Moderate-----	0.32	5	7	2-3
	16-36	30-42	1.45-1.65	0.2-0.6	0.09-0.11	5.1-7.3	Moderate-----	0.32			
	36-46	24-35	1.45-1.65	0.2-2.0	0.15-0.19	5.1-7.3	Moderate-----	0.32			
	46-60	18-30	1.50-1.70	0.2-2.0	0.11-0.22	6.1-8.4	Low----------	0.43			
8077------------- Huntsville	0-32	18-27	1.15-1.35	0.6-2.0	0.22-0.24	6.1-7.3	Moderate-----	0.28	5	6	3-4
	32-60	15-25	1.20-1.50	0.6-2.0	0.12-0.21	6.1-7.8	Low----------	0.28			
8107------------- Sawmill	0-25	27-35	1.20-1.40	0.6-2.0	0.21-0.23	6.1-7.8	Moderate-----	0.28	5	7	4-5
	25-33	27-35	1.20-1.40	0.6-2.0	0.21-0.23	6.1-7.8	Moderate-----	0.28			
	33-60	25-35	1.30-1.45	0.6-2.0	0.17-0.20	6.1-7.8	Moderate-----	0.28			

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodi-bility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH					Pct
8304-------------- Landes	0-9	7-20	1.40-1.60	2.0-6.0	0.13-0.20	6.1-8.4	Low-----------	0.20	4	3	1-2
	9-38	5-18	1.60-1.70	2.0-6.0	0.10-0.15	6.1-8.4	Low-----------	0.32			
	38-60	5-18	1.60-1.80	6.0-20	0.05-0.15	6.1-8.4	Low-----------	0.20			
8378-------------- Lanier	0-7	5-16	1.20-1.50	2.0-20	0.08-0.15	6.6-7.8	Low-----------	0.15	3	8	1-4
	7-60	1-8	1.30-1.60	>6.0	0.02-0.06	7.4-8.4	Low-----------	0.15			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--SOIL AND WATER FEATURES

("Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Soil name and map symbol	Hydrologic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Potential frost action	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete
					Ft					
23B---------------- Blount	C	None---------	---	---	1.0-3.0	Perched	Jan-May	High-----	High-----	High.
25G---------------- Hennepin	B	None---------	---	---	>6.0	---	---	Moderate	Low------	Low.
27C2, 27D2, 27F--- Miami	B	None---------	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
36B, 36C2--------- Tama	B	None---------	---	---	4.0-6.0	Apparent	Nov-Jun	High-----	Moderate	Moderate.
37B---------------- Worthen	B	None---------	---	---	>6.0	---	---	High-----	Low------	Low.
41----------------- Muscatine	B	None---------	---	---	2.0-4.0	Apparent	Nov-Jul	High-----	High-----	Moderate.
53B, 53D---------- Bloomfield	A	None---------	---	---	>6.0	---	---	Low------	Low------	High.
67----------------- Harpster	B/D	None---------	---	---	+.5-2.0	Apparent	Feb-Jun	High-----	High-----	Low.
68----------------- Sable	B/D	None---------	---	---	+.5-2.0	Apparent	Mar-Jun	High-----	High-----	Low.
93B, 93E, 93G----- Rodman	A	None---------	---	---	>6.0	---	---	Low------	Low------	Low.
98B, 98D---------- Ade	A	None---------	---	---	>6.0	---	---	Low------	Low------	High.
131B2, 131D, 131F- Alvin	B	None---------	---	---	>6.0	---	---	Moderate	Low------	High.
134B, 134C-------- Camden	B	None---------	---	---	>6.0	---	---	High-----	Low------	Moderate.
145C2------------- Saybrook	B	None---------	---	---	4.0-6.0	Apparent	Mar-Jun	High-----	High-----	Moderate.
151---------------- Ridgeville	B	None---------	---	---	1.0-3.0	Apparent	Feb-May	High-----	Moderate	Moderate.
154---------------- Flanagan	B	None---------	---	---	1.5-3.5	Apparent	Mar-Jun	High-----	High-----	Moderate.
171B, 171C2------- Catlin	B	None---------	---	---	3.5-6.0	Apparent	Feb-May	High-----	High-----	Moderate.
194C2------------- Morley	C	None---------	---	---	3.0-6.0	Perched	Mar-May	Moderate	High-----	Moderate.
194D2, 194F------- Morley	C	None---------	---	---	>6.0	---	---	Moderate	High-----	Moderate.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months		Uncoated steel	Concrete
					Ft					
200------------- Orio	B/D	None--------	---	---	+.5-1.0	Apparent	Mar-Jun	High-----	High-----	Moderate.
205C, 205D-------- Metea	B	None--------	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
223B2, 223C2------ Varna	C	None--------	---	---	3.0-6.0	Perched	Mar-May	High-----	Moderate	Moderate.
233B, 233C2------- Birkbeck	B	None--------	---	---	3.0-6.0	Apparent	Mar-May	High-----	High-----	Moderate.
236------------- Sabina	C	None--------	---	---	1.5-3.5	Apparent	Mar-Jun	High-----	High-----	Moderate.
278------------- Stronghurst	B	None--------	---	---	1.0-3.0	Apparent	Apr-Jun	High-----	High-----	Moderate.
279B------------ Rozetta	B	None--------	---	---	4.0-6.0	Apparent	Mar-Jun	High-----	Moderate	Moderate.
280C2, 359D------- Fayette	B	None--------	---	---	>6.0	---	---	High-----	Moderate	Moderate.
379A, 379B2------- Dakota	B	None--------	---	---	>6.0	---	---	Moderate	Low------	Moderate.
386B------------ Downs	B	None--------	---	---	4.0-6.0	Apparent	Mar-Jun	High-----	Moderate	Moderate.
398A, 398B-------- Wea	B	None--------	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
533*. Urban land										
536*. Dumps										
552------------- Drummer	B/D	None--------	---	---	+.5-2.0	Apparent	Mar-Jun	High-----	High-----	Moderate.
570A, 570C-------- Martinsville	B	None--------	---	---	>6.0	---	---	Moderate	Moderate	Moderate.
587B------------ Terril	B	None--------	---	---	>6.0	---	---	Moderate	Moderate	Low.
802B. Orthents										
819G*:										
Hennepin---------	B	None--------	---	---	>6.0	---	---	Moderate	Low------	Low.
Vanmeter---------	C	None--------	---	---	>6.0	---	---	Moderate	High-----	Low.
865*. Pits										

See footnote at end of table.

TABLE 18.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months		Uncoated steel	Concrete
					Ft					
1480, 3480--------- Moundprairie	B/D	Frequent----	Brief-----	Mar-Jun	+1-1.5	Apparent	Mar-Nov	High-----	High-----	Low.
7081--------------- Littleton	B	Rare---------	---	---	1.0-3.0	Apparent	Apr-Jun	High-----	High-----	Low.
7107--------------- Sawmill	B/D	Rare---------	---	---	0-2.0	Apparent	Mar-Jun	High-----	High-----	Low.
7302--------------- Ambraw	B/D	Rare---------	---	---	0-2.0	Apparent	Mar-Jun	High-----	High-----	Moderate.
8077--------------- Huntsville	B	Occasional	Very brief	Mar-Jun	4.0-6.0	Apparent	Mar-Jun	High-----	Low------	Low.
8107--------------- Sawmill	B/D	Occasional	Brief-----	Mar-Jun	0-2.0	Apparent	Mar-Jun	High-----	High-----	Low.
8304--------------- Landes	B	Occasional	Brief-----	Mar-Jun	>6.0	---	---	Moderate	Low------	Low.
8378--------------- Lanier	A	Occasional	Brief-----	Mar-Jun	>6.0	---	---	Low------	Low------	Low.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 19.--CLASSIFICATION OF THE SOILS

(An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series)

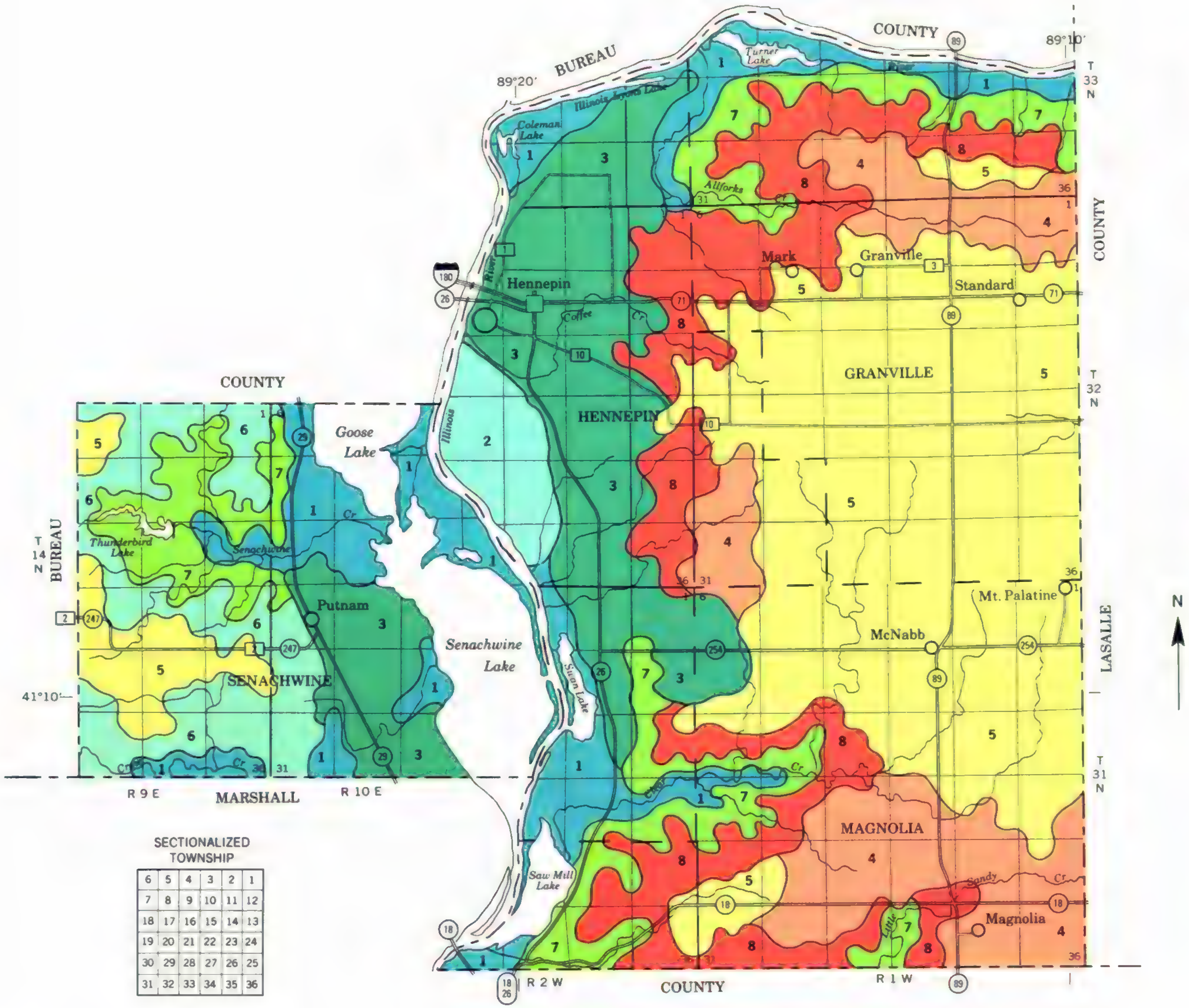
Soil name	Family or higher taxonomic class
Ade	Coarse-loamy, mixed, mesic Psammentic Argiudolls
Alvin	Coarse-loamy, mixed, mesic Typic Hapludalfs
Ambraw	Fine-loamy, mixed, mesic Fluvaquentic Haplaquolls
Birkbeck	Fine-silty, mixed, mesic Typic Hapludalfs
Bloomfield	Sandy, mixed, mesic Psammentic Hapludalfs
Blount	Fine, illitic, mesic Aeric Ochraqualfs
Camden	Fine-silty, mixed, mesic Typic Hapludalfs
Catlin	Fine-silty, mixed, mesic Typic Argiudolls
Dakota	Fine-loamy over sandy or sandy-skeletal, mixed, mesic Typic Argiudolls
Downs	Fine-silty, mixed, mesic Mollic Hapludalfs
Drummer	Fine-silty, mixed, mesic Typic Haplaquolls
Fayette	Fine-silty, mixed, mesic Typic Hapludalfs
*Flanagan	Fine, montmorillonitic, mesic Aquic Argiudolls
Harpster	Fine-silty, mesic Typic Calciaquolls
Hennepin	Fine-loamy, mixed, mesic Typic Eutrochrepts
Huntsville	Fine-silty, mixed, mesic Cumulic Hapludolls
Landes	Coarse-loamy, mixed, mesic Fluventic Hapludolls
Lanier	Sandy-skeletal, mixed, mesic Fluventic Hapludolls
*Littleton	Fine-silty, mixed, mesic Cumulic Hapludolls
Martinsville	Fine-loamy, mixed, mesic Typic Hapludalfs
Metea	Loamy, mixed, mesic Arenic Hapludalfs
Miami	Fine-loamy, mixed, mesic Typic Hapludalfs
Morley	Fine, illitic, mesic Typic Hapludalfs
Moundprairie	Fine-silty, mixed (calcareous), mesic Mollic Fluvaquents
*Muscatine	Fine-silty, mixed, mesic Aquic Hapludolls
*Orio	Fine-loamy, mixed, mesic Mollic Ochraqualfs
Orthents	Fine-loamy, mixed, mesic Udorthents
Ridgeville	Coarse-loamy, mixed, mesic Aquic Argiudolls
Rodman	Sandy-skeletal, mixed, mesic Typic Hapludolls
Rozetta	Fine-silty, mixed, mesic Typic Hapludalfs
Sabina	Fine, montmorillonitic, mesic Aeric Ochraqualfs
Sable	Fine-silty, mixed, mesic Typic Haplaquolls
Sawmill	Fine-silty, mixed, mesic Cumulic Haplaquolls
*Saybrook	Fine-silty, mixed, mesic Typic Argiudolls
Stronghurst	Fine-silty, mixed, mesic Aeric Ochraqualfs
Tama	Fine-silty, mixed, mesic Typic Argiudolls
Terril	Fine-loamy, mixed, mesic Cumulic Hapludolls
Vanmeter	Fine, illitic, mesic Typic Eutrochrepts
*Varna	Fine, illitic, mesic Typic Argiudolls
Wea	Fine-loamy, mixed, mesic Typic Argiudolls
Worthen	Fine-silty, mixed, mesic Cumulic Hapludolls

☆ U.S. GOVERNMENT PRINTING OFFICE: 1992—311-694/60505

NRCS Accessibility Statement

This document is not accessible by screen-reader software. The Natural Resources Conservation Service (NRCS) is committed to making its information accessible to all of its customers and employees. If you are experiencing accessibility issues and need assistance, please contact our Helpdesk by phone at 1-800-457-3642 or by e-mail at ServiceDesk-FTC@ftc.usda.gov. For assistance with publications that include maps, graphs, or similar forms of information, you may also wish to contact our State or local office. You can locate the correct office and phone number at http://offices.sc.egov.usda.gov/locator/app.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.



SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

SOIL LEGEND*

NEARLY LEVEL SOILS THAT ARE SUBJECT TO FLOODING

1 MOUNDPRAIRIE ASSOCIATION: Poorly drained, frequently flooded, silty soils that formed in alluvium; on flood plains

2 SAWMILL ASSOCIATION: Poorly drained, rarely flooded, silty soils that formed in alluvium; on flood plains

NEARLY LEVEL TO STEEP SOILS THAT ARE SUBJECT TO SOIL BLOWING, WATER EROSION, OR BOTH

3 WEA-ADE-ALVIN ASSOCIATION: Well drained and somewhat excessively drained, silty, sandy, and loamy soils that formed in loamy sediments and the underlying sandy or gravelly material or in sandy eolian material or loamy sediments; on terraces and uplands

NEARLY LEVEL TO SLOPING SOILS THAT ARE SUBJECT TO WATER EROSION OR ARE LIMITED BY WETNESS

4 CATLIN-FLANAGAN ASSOCIATION: Moderately well drained and somewhat poorly drained, silty soils that formed in loess and in the underlying glacial till; on uplands

5 TAMA-MUSCATINE-SABLE ASSOCIATION: Moderately well drained to poorly drained, silty soils that formed in loess; on uplands

GENTLY SLOPING TO VERY STEEP SOILS THAT ARE SUBJECT TO WATER EROSION

6 ROZETTA-FAYETTE-MIAMI ASSOCIATION: Gently sloping to steep, moderately well drained and well drained, silty and loamy soils that formed in loess or glacial till; on uplands

7 HENNEPIN-MIAMI-MORLEY ASSOCIATION: Sloping to very steep, well drained and moderately well drained, loamy and silty soils that formed in glacial till; on uplands

8 BIRKBECK-ROZETTA-FAYETTE ASSOCIATION: Gently sloping to strongly sloping, moderately well drained and well drained, silty soils that formed in loess and the underlying glacial till or entirely in loess; on uplands

* Unless otherwise indicated, the texture given in the descriptive heading of each association refers to the surface layer of the major soils in that association.

Compiled 1991

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
ILLINOIS AGRICULTURAL EXPERIMENT STATION

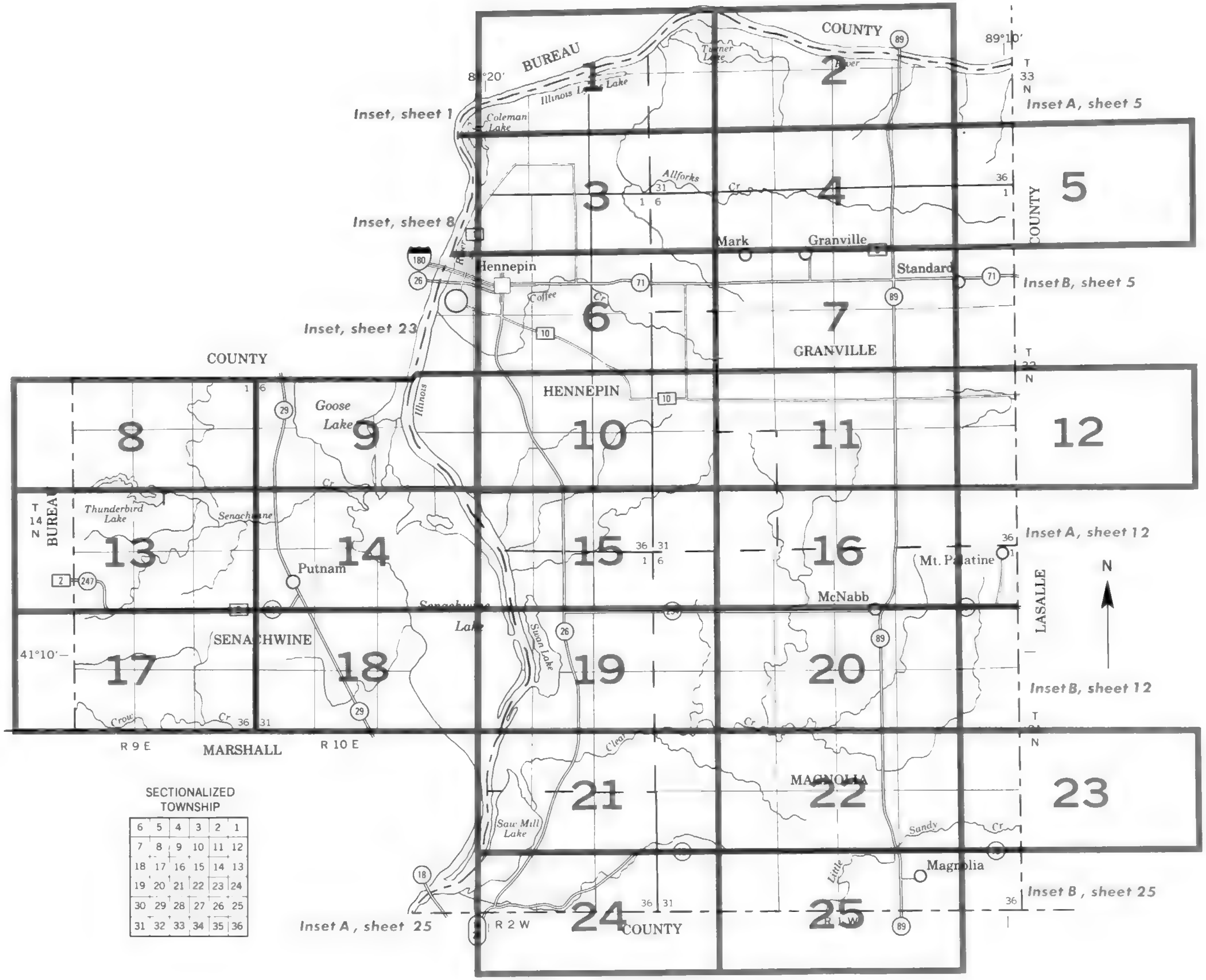
GENERAL SOIL MAP

PUTNAM COUNTY, ILLINOIS

Scale 1:126,720

1 0 1 2 3 4 Mi

1 0 3 6 Km



INDEX TO MAP SHEETS
PUTNAM COUNTY, ILLINOIS

Scale 1:126,720

1 0 1 2 3 4 Mi

1 0 3 6 Km

SOIL LEGEND

Map symbols consist of numbers or a combination of numbers and a letter. The initial numbers represent the kind of soils. A capital letter following these numbers indicates the class of slope. Symbols without a slope letter are for nearly level soils or miscellaneous areas. A final number of 2 following the slope letter indicates that the soil is moderately eroded.

SYMBOL	NAME
23B	Blount silt loam, 1 to 5 percent slopes
25G	Hennepin loam, 30 to 60 percent slopes
27C2	Miami silt loam, 5 to 10 percent slopes, eroded
27D2	Miami loam, 10 to 18 percent slopes, eroded
27F	Miami loam, 18 to 30 percent slopes
36B	Tama silt loam, 2 to 5 percent slopes
36C2	Tama silt loam, 5 to 10 percent slopes, eroded
37B	Worthen silt loam, 1 to 5 percent slopes
41	Muscatine silt loam
53B	Bloomfield loamy fine sand, 1 to 7 percent slopes
53D	Bloomfield loamy fine sand, 7 to 20 percent slopes
67	Harpster silty clay loam
68	Sable silty clay loam
93B	Rodman gravelly loam, 2 to 7 percent slopes
93E	Rodman gravelly sandy loam, 12 to 30 percent slopes
93G	Rodman gravelly sandy loam, 30 to 60 percent slopes
98B	Ade loamy fine sand, 1 to 7 percent slopes
98D	Ade loamy fine sand, 7 to 15 percent slopes
131B2	Alvin fine sandy loam, 2 to 7 percent slopes, eroded
131D	Alvin fine sandy loam, 7 to 20 percent slopes
131F	Alvin fine sandy loam, 20 to 30 percent slopes
134B	Camden silt loam, 2 to 5 percent slopes
134C	Camden silt loam, 5 to 10 percent slopes
145C2	Saybrook silt loam, 5 to 10 percent slopes, eroded
151	Ridgeville fine sandy loam
154	Flanagan silt loam
171B	Catlin silt loam, 2 to 5 percent slopes
171C2	Catlin silt loam, 5 to 10 percent slopes, eroded
194C2	Morley silt loam, 5 to 10 percent slopes, eroded
194D2	Morley silty clay loam, 10 to 18 percent slopes, eroded
194F	Morley silt loam, 18 to 35 percent slopes
200	Orio fine sandy loam
205C	Metea loamy fine sand, 5 to 10 percent slopes
205D	Metea loamy fine sand, 10 to 15 percent slopes
223B2	Varna silty clay loam, 2 to 5 percent slopes, eroded
223C2	Varna silty clay loam, 5 to 10 percent slopes, eroded
233B	Birkbeck silt loam, 2 to 5 percent slopes
233C2	Birkbeck silt loam, 5 to 10 percent slopes, eroded
236	Sabina silt loam
278	Stronghurst silt loam
279B	Rozetta silt loam, 2 to 5 percent slopes
280C2	Fayette silt loam, 5 to 10 percent slopes, eroded
359D	Fayette silt loam, till substratum, 10 to 15 percent slopes
379A	Dakota loam, 0 to 2 percent slopes
379B2	Dakota loam, 2 to 5 percent slopes, eroded
386B	Downs silt loam, 2 to 5 percent slopes
398A	Wea silt loam, 0 to 2 percent slopes
398B	Wea silt loam, 2 to 5 percent slopes
533	Urban land
536	Dumps, mine
552	Drummer silty clay loam, till substratum
570A	Martinsville loam, 0 to 2 percent slopes
570C	Martinsville fine sandy loam, 5 to 10 percent slopes
587B	Terril loam, 1 to 7 percent slopes
802B	Orthents, loamy, undulating
819G	Hennepin-Vanmeter complex, 30 to 60 percent slopes
865	Pits, gravel
1480	Moundprairie silty clay loam, wet
3480	Moundprairie silty clay loam, frequently flooded
7081	Littleton silt loam, rarely flooded
7107	Sawmill silty clay loam, rarely flooded
7302	Ambraw silty clay loam, rarely flooded
8077	Huntsville silt loam, occasionally flooded
8107	Sawmill silty clay loam, occasionally flooded
8304	Landes fine sandy loam, occasionally flooded
8378	Lanier gravelly sandy loam, occasionally flooded

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- County or parish
- Reservation (state forest or park)
- Field sheet matchline and neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield and cemetery

STATE COORDINATE TICK

LAND DIVISION CORNER (sections)

ROAD EMBLEM & DESIGNATIONS

- Interstate
- State

LEVEES

- Without road

DAMS

- Large (to scale)
- Medium or Small

PITS

- Gravel pit
- Mine or quarry

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Drainage ditch

LAKES, PONDS AND RESERVOIRS

- Perennial

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS

ESCARPMENTS

- Other than bedrock (points down slope)

SHORT STEEP SLOPE

SOIL SAMPLE (normally not shown)

MISCELLANEOUS

- Blowout
- Gravelly spot
- Dumps, etc
- Rock outcrop (includes sandstone and shale)
- Sandy spot
- Severely eroded spot
- Muck spot
- Calcareous spot

1

N

This soil survey map was compiled by the U S Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1979 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

PUTNAM COUNTY, ILLINOIS NO. 1

SCALE 1:15 840

1 MILE

1 KILOMETER

N

1 3/4 1/2 1/4 0 1 MILE

1 0.5 0 1 KILOMETER

SCALE 1:15 840

PUTNAM COUNTY, ILLINOIS NO. 2

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1979 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

3

N

1 3/4 1/2 1/4 0 1 MILE

1 0.5 0 1 KILOMETER

SCALE 1:15 840

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1979 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

PUTNAM COUNTY, ILLINOIS NO. 3

SCALE 1:15 840

PUTNAM COUNTY, ILLINOIS NO. 4

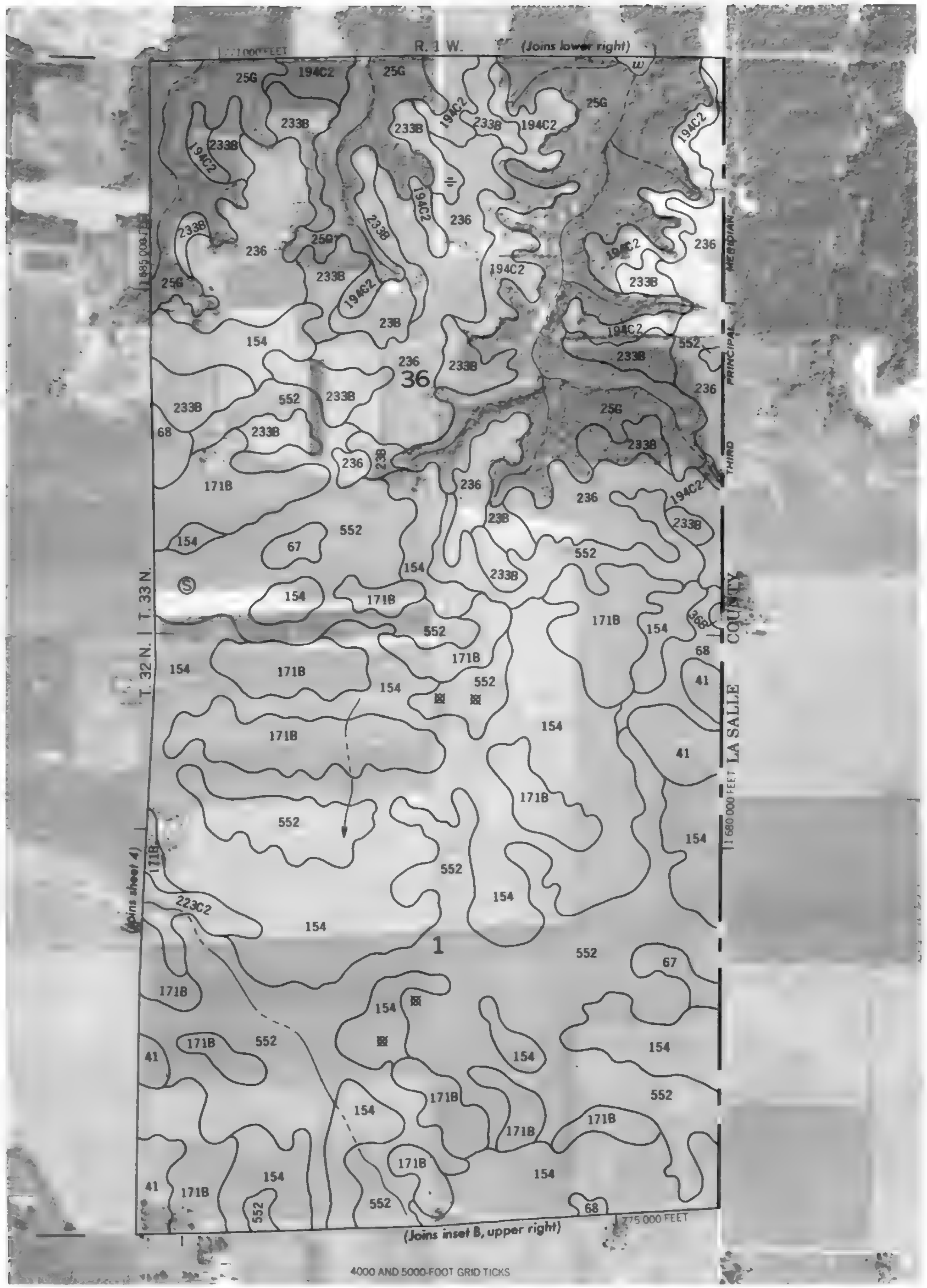
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1979 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

5

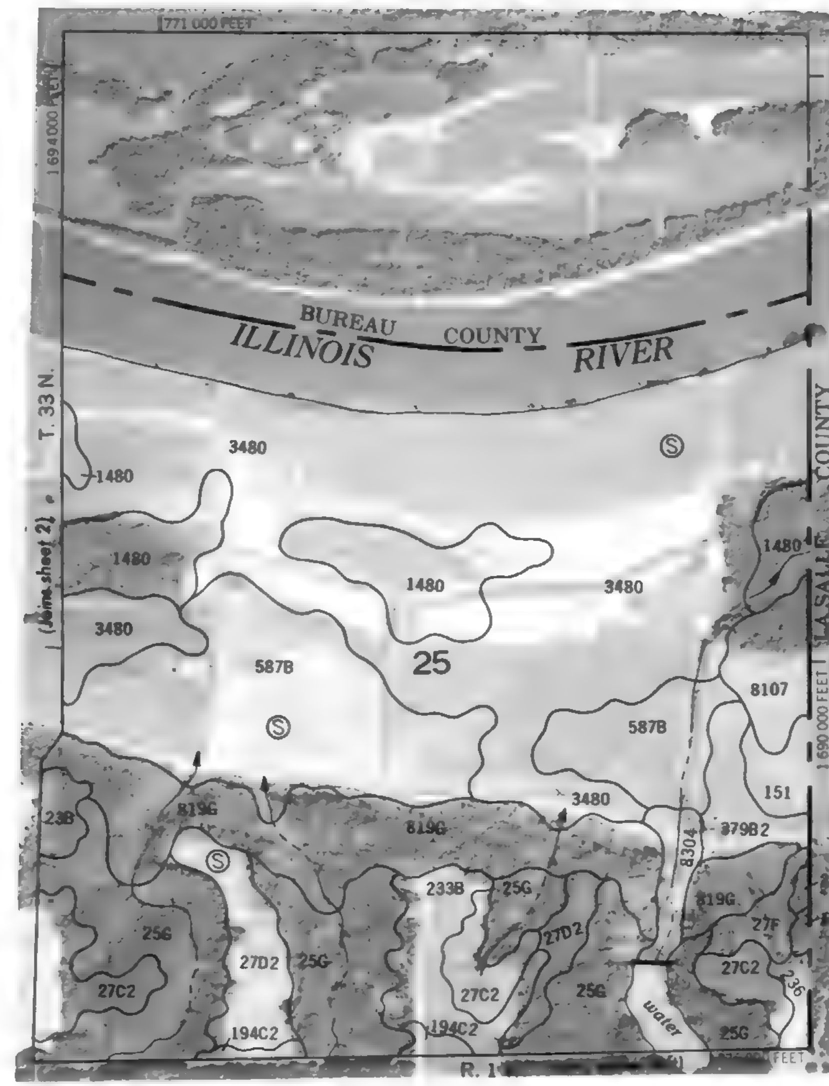
N

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1979 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

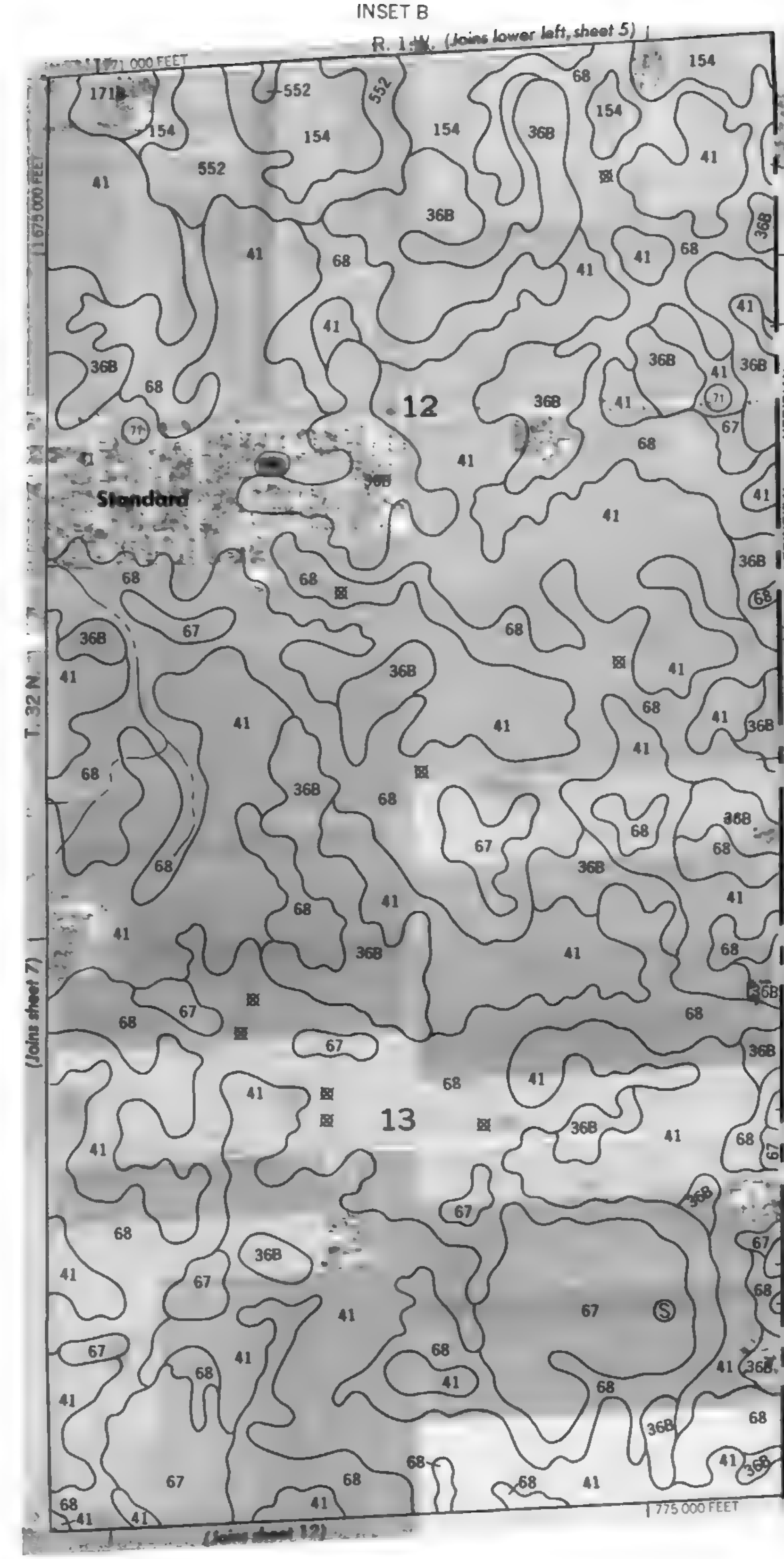
PUTNAM COUNTY, ILLINOIS NO. 5



INSET A



INSET B



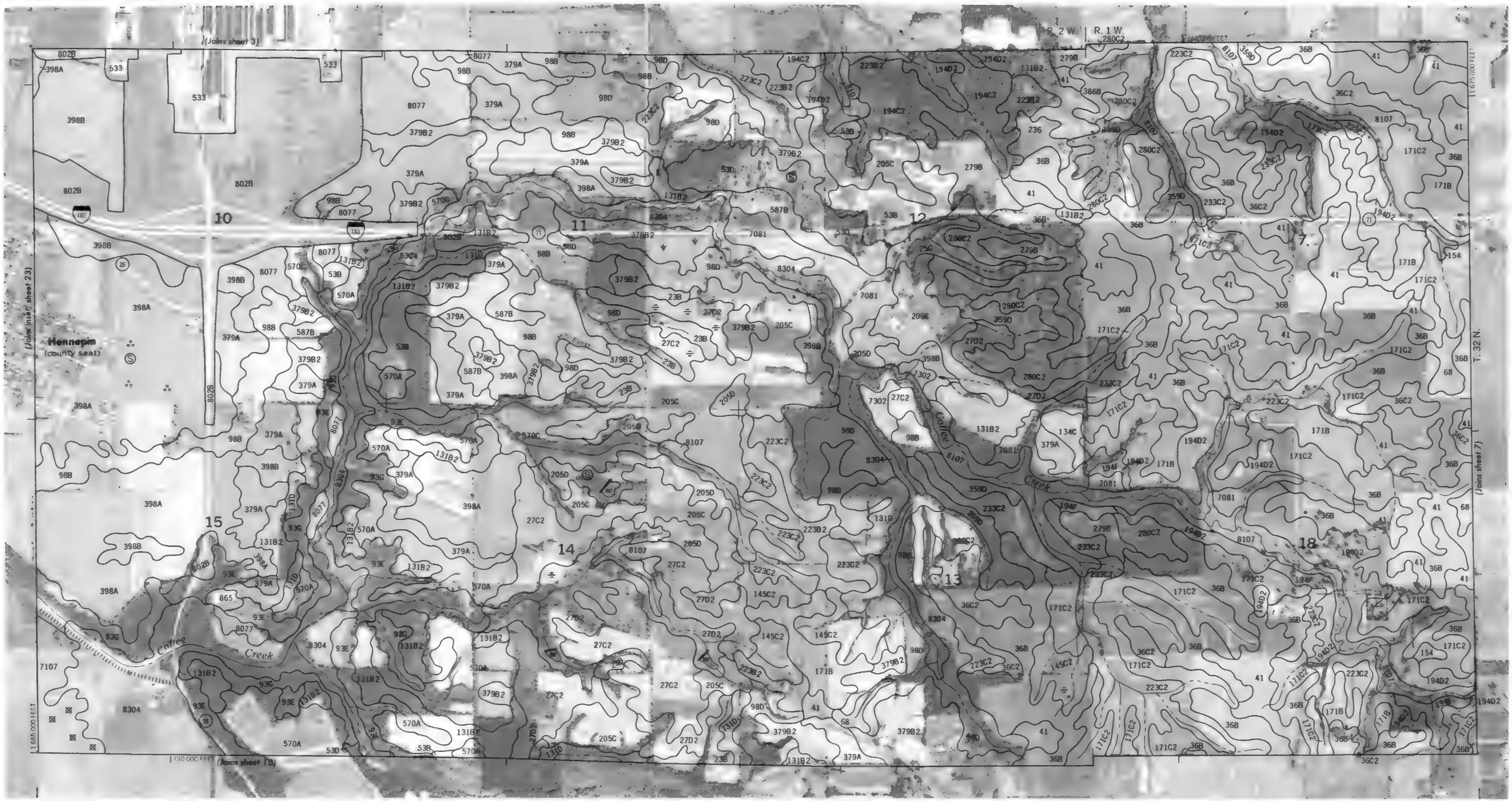
1 3/4 1/2 1/4 0 1 MILE

1 0.5 0 1 KILOMETER

SCALE 1:15 840

6

N



SCALE 1:15 840

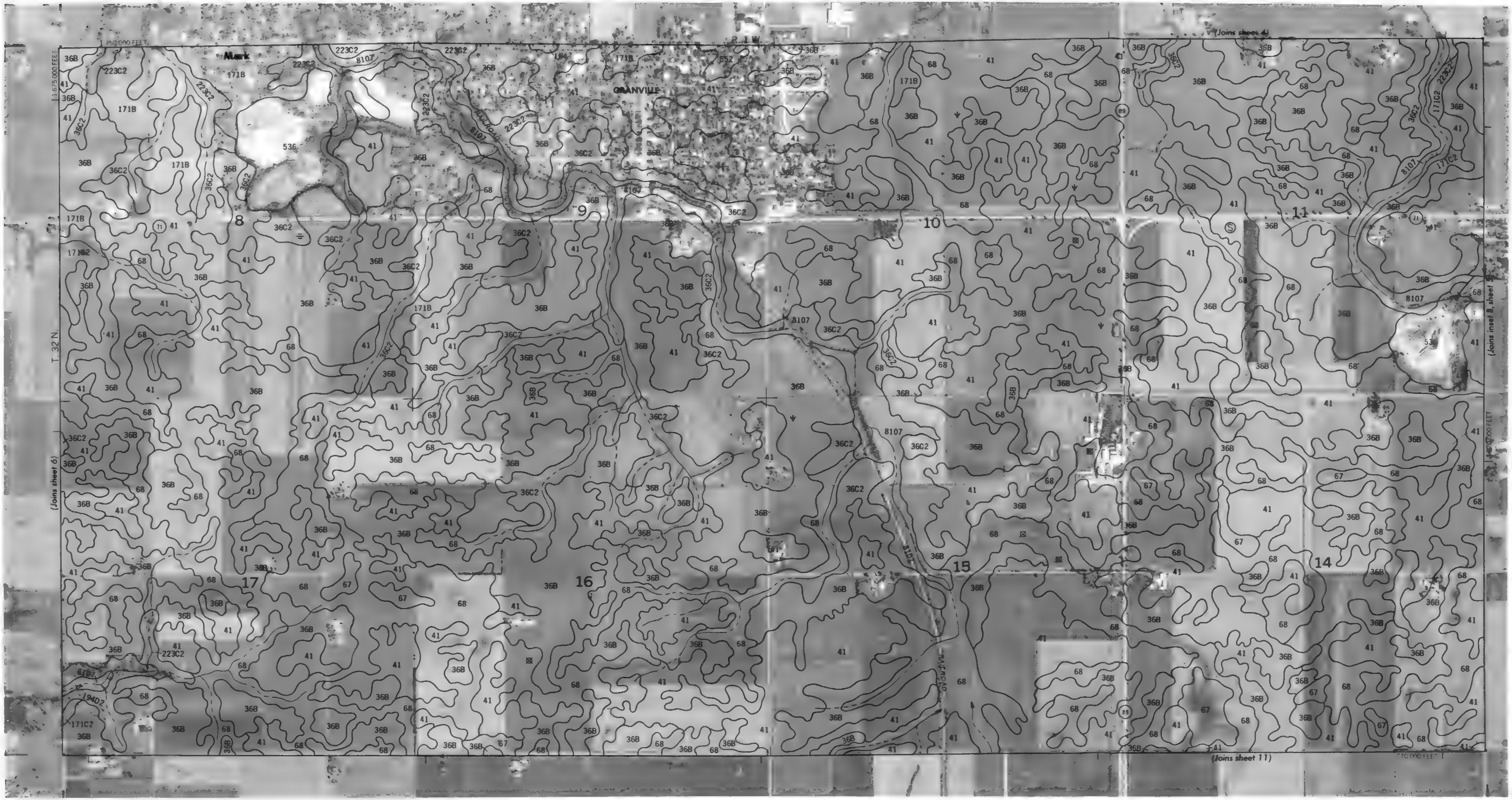
PUTNAM COUNTY, ILLINOIS NO. 6

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1979 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

SOIL SURVEY OF PUTNAM COUNTY, ILLINOIS — SHEET NUMBER 7

7

N



This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1979 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

PUTNAM COUNTY, ILLINOIS NO. 7

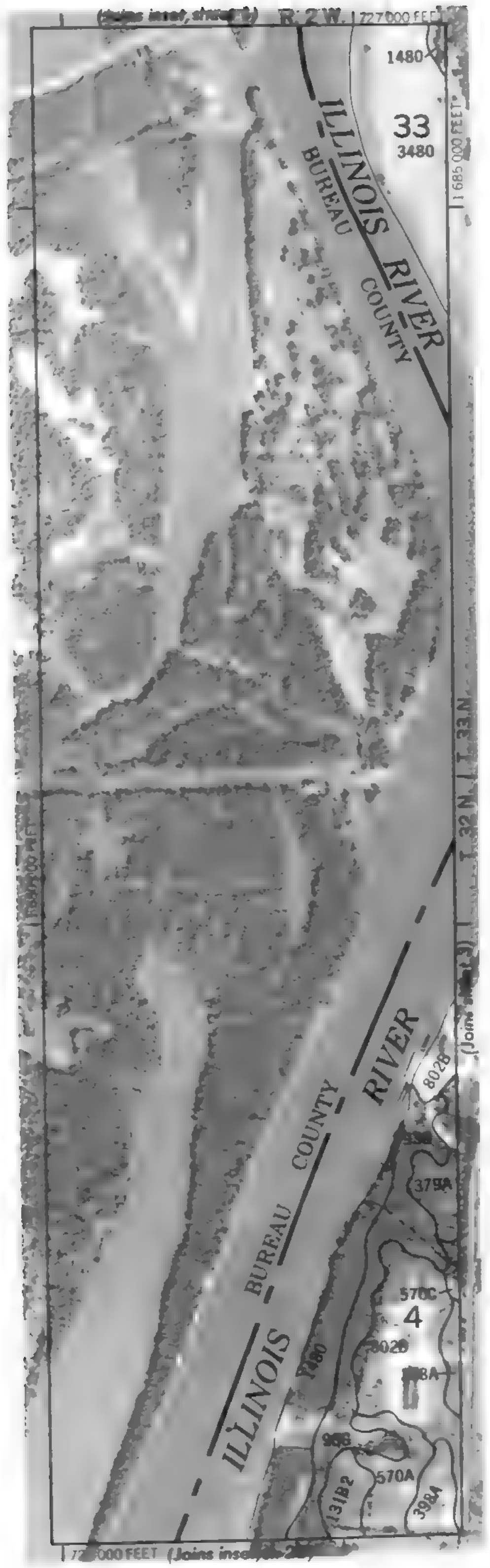
1 3/4 1/2 1/4 0 1 MILE

1 0.5 0 1 KILOMETER

SCALE 1:15 840

8

N



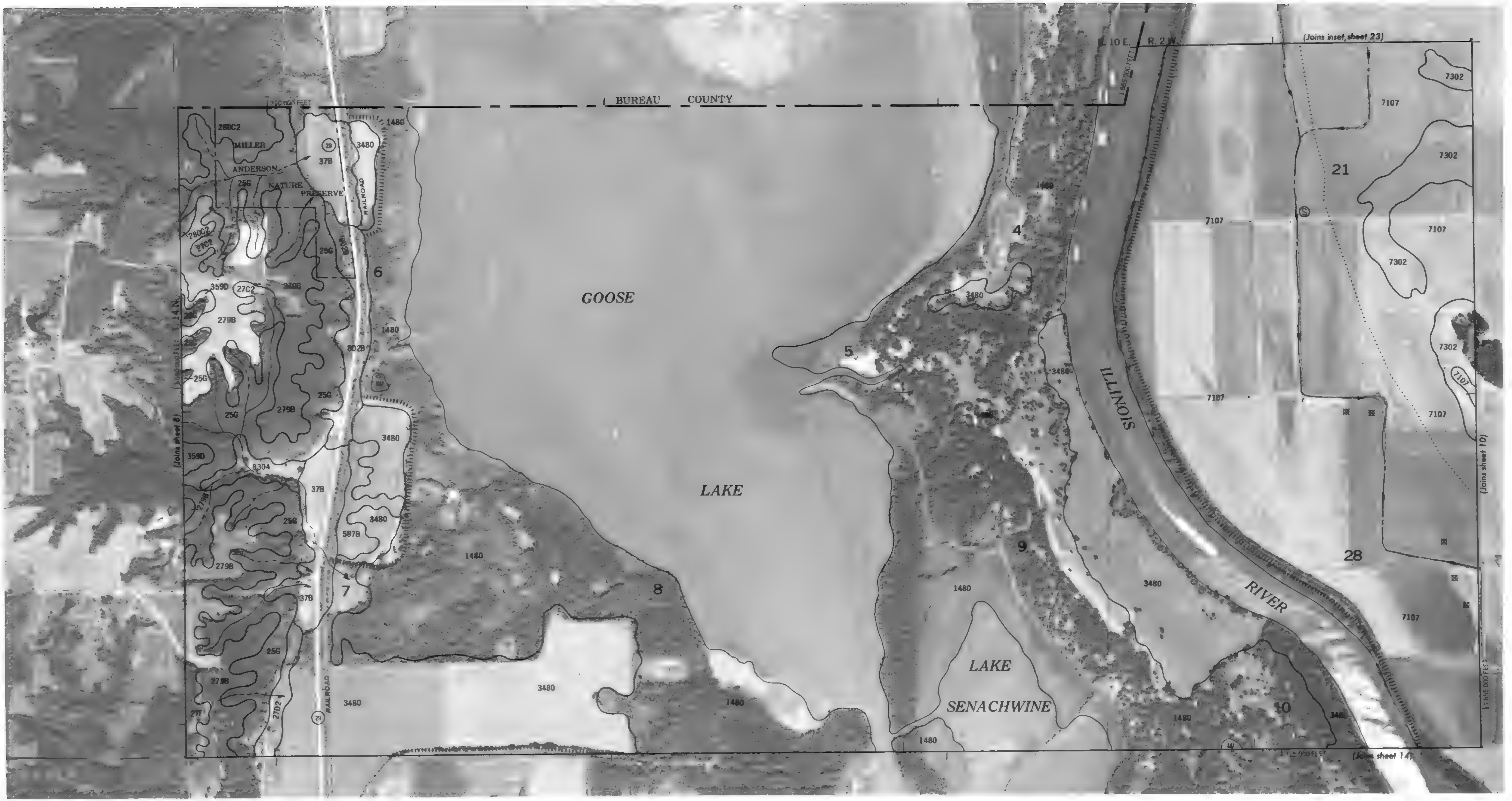
SCALE 1:15 840

PUTNAM COUNTY, ILLINOIS NO. 8

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1979 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1979 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

PUTNAM COUNTY, ILLINOIS NO. 9



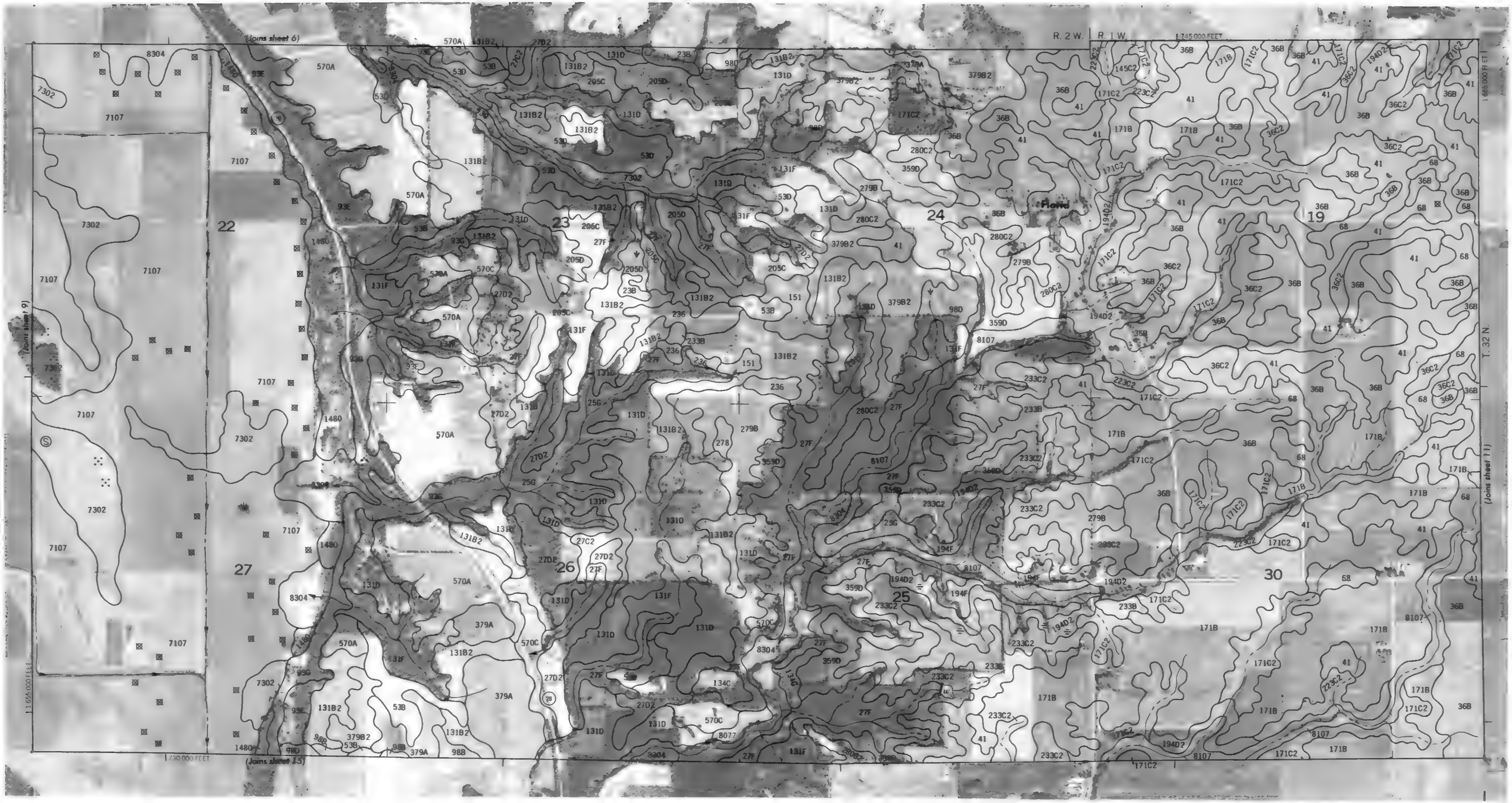
1 3/4 1/2 1/4 0 1 MILE

1 0.5 0 1 KILOMETER

SCALE 1:15 840

(10)

N



1 MILE

1 KILOMETER

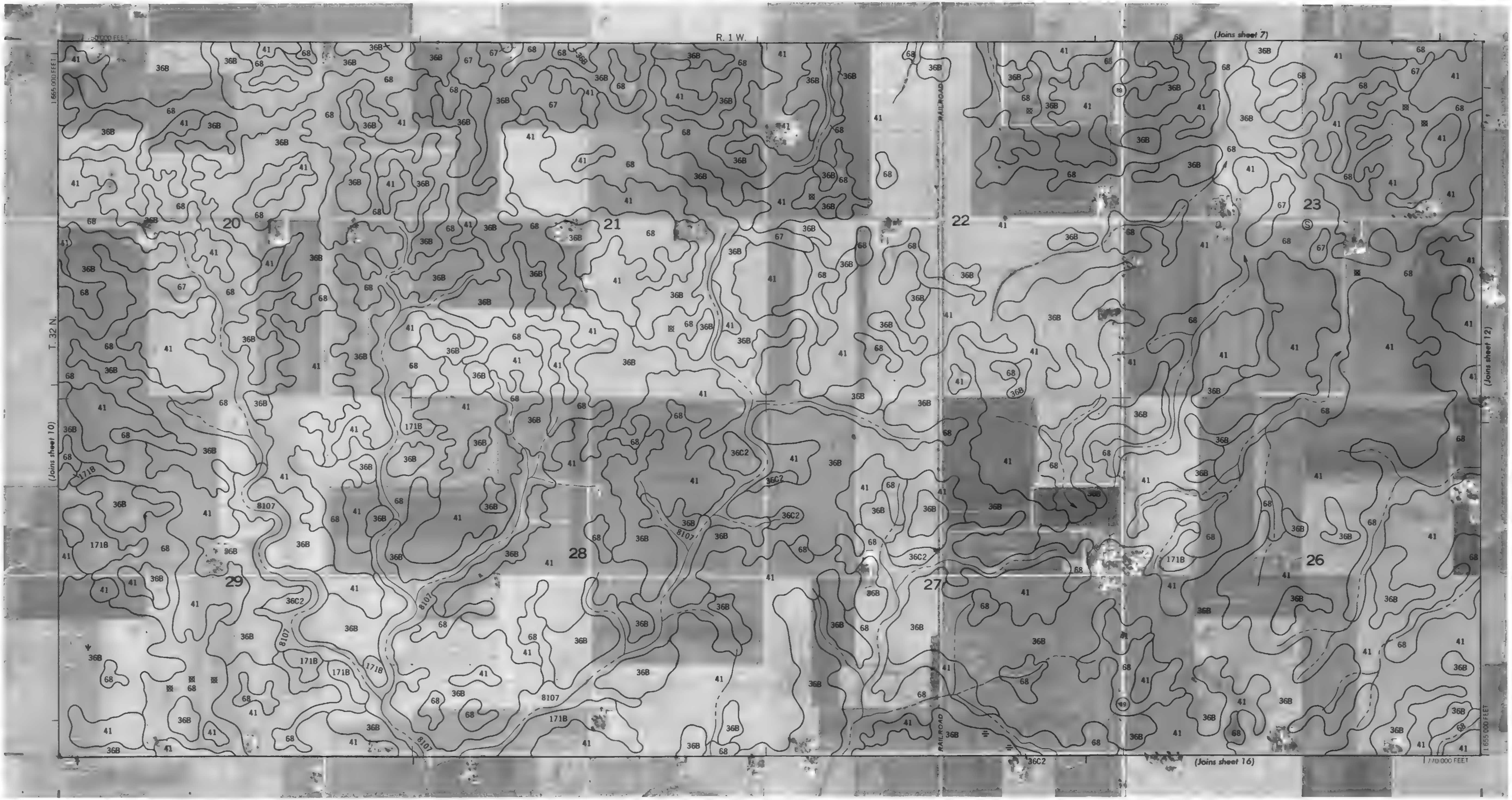
SCALE 1:15 840

PUTNAM COUNTY, ILLINOIS NO. 10

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1979 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

11

N



1 3/4 1/2 1/4 0 1 MILE

1 0.5 0 1 KILOMETER

SCALE 1:15 840

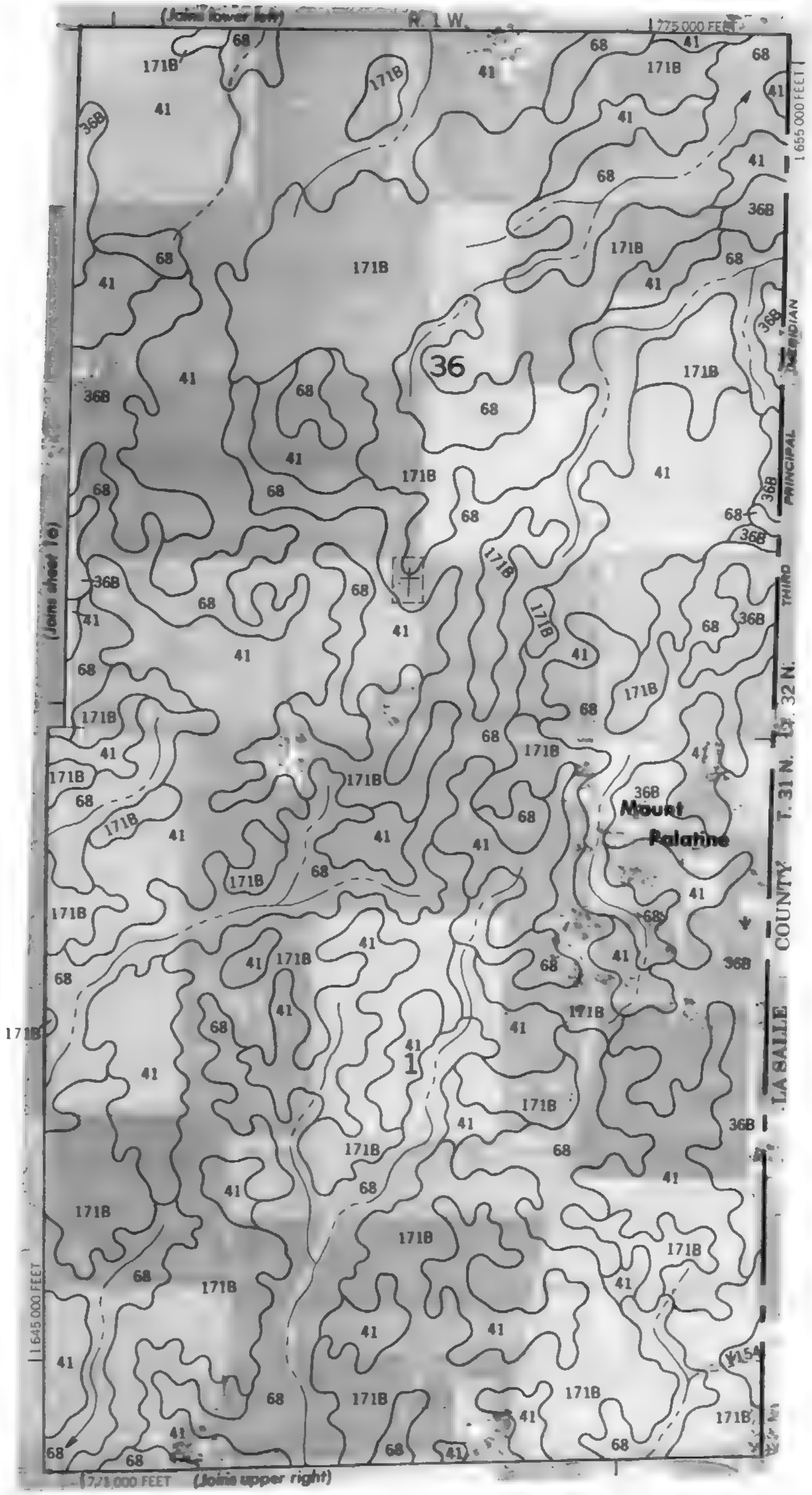
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1979 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

PUTNAM COUNTY, ILLINOIS NO. 11

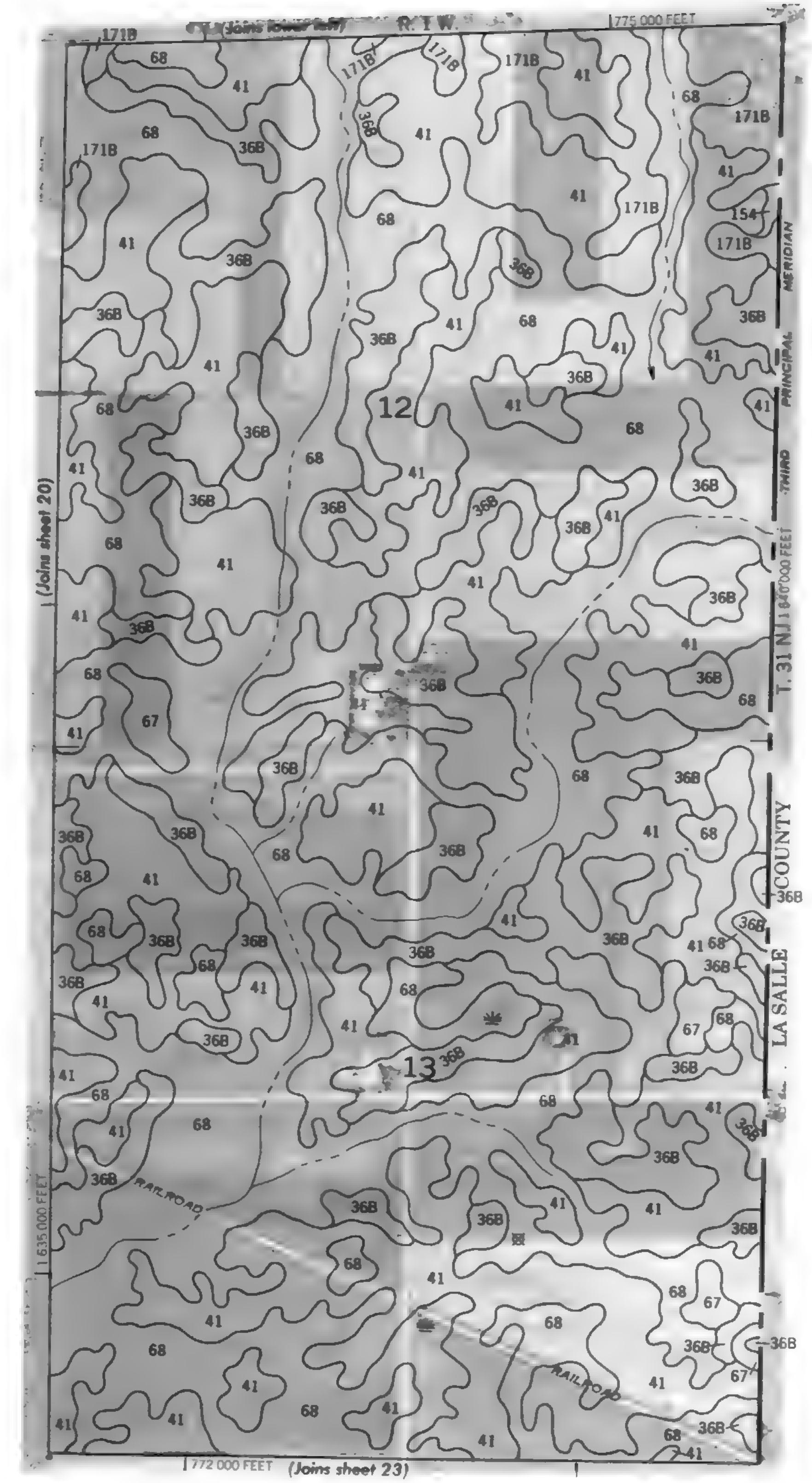
12

N

INSET A



INSET B



1 MILE

0.5 1 KILOMETER

SCALE 1:15 840

PUTNAM COUNTY, ILLINOIS NO. 12

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1979 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

(13)

N

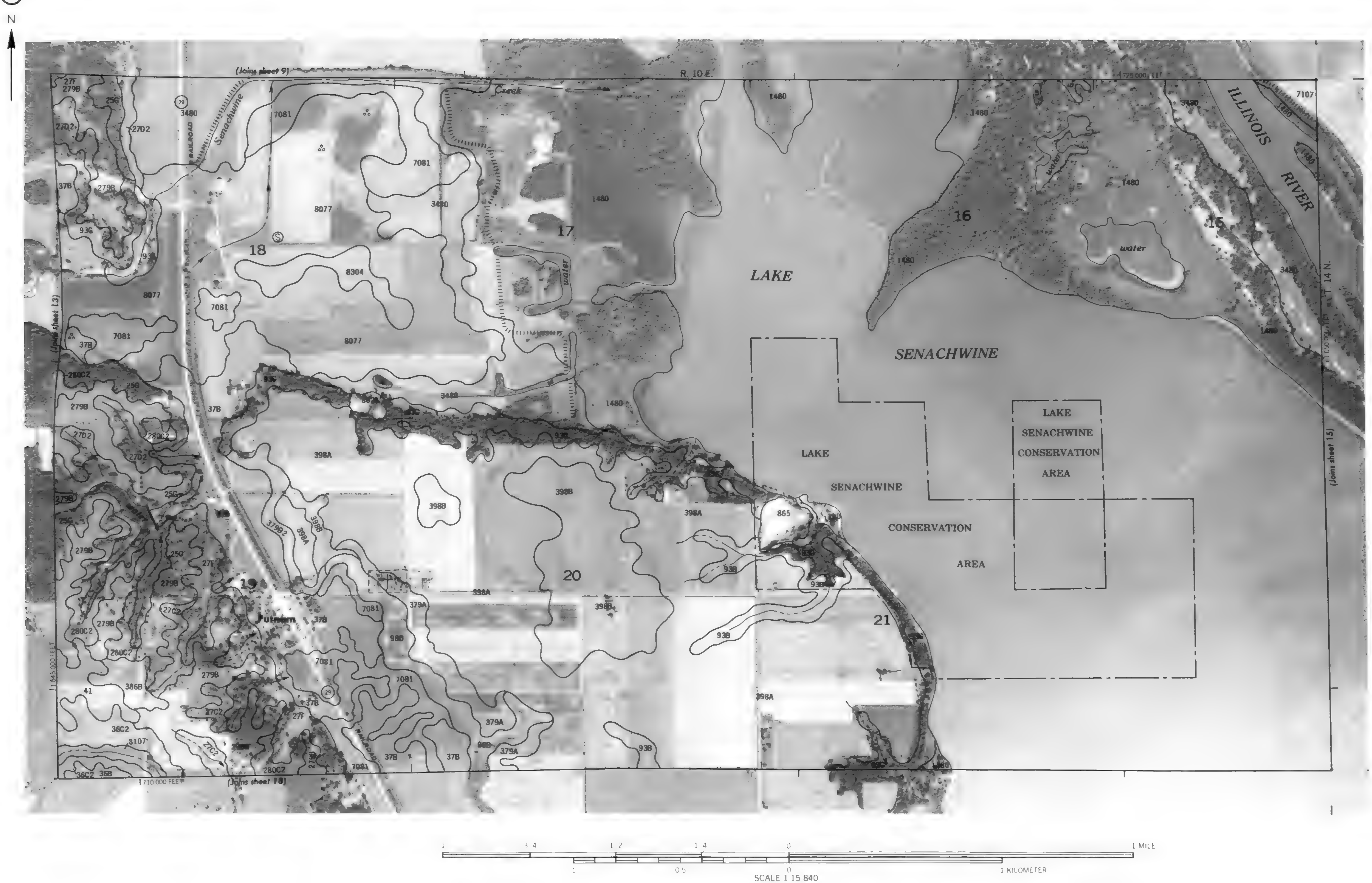
1 3/4 1/2 1/4 0 1 MILE

1 0.5 0 1 KILOMETER

SCALE 1:15 840

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1979 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

PUTNAM COUNTY, ILLINOIS NO. 13



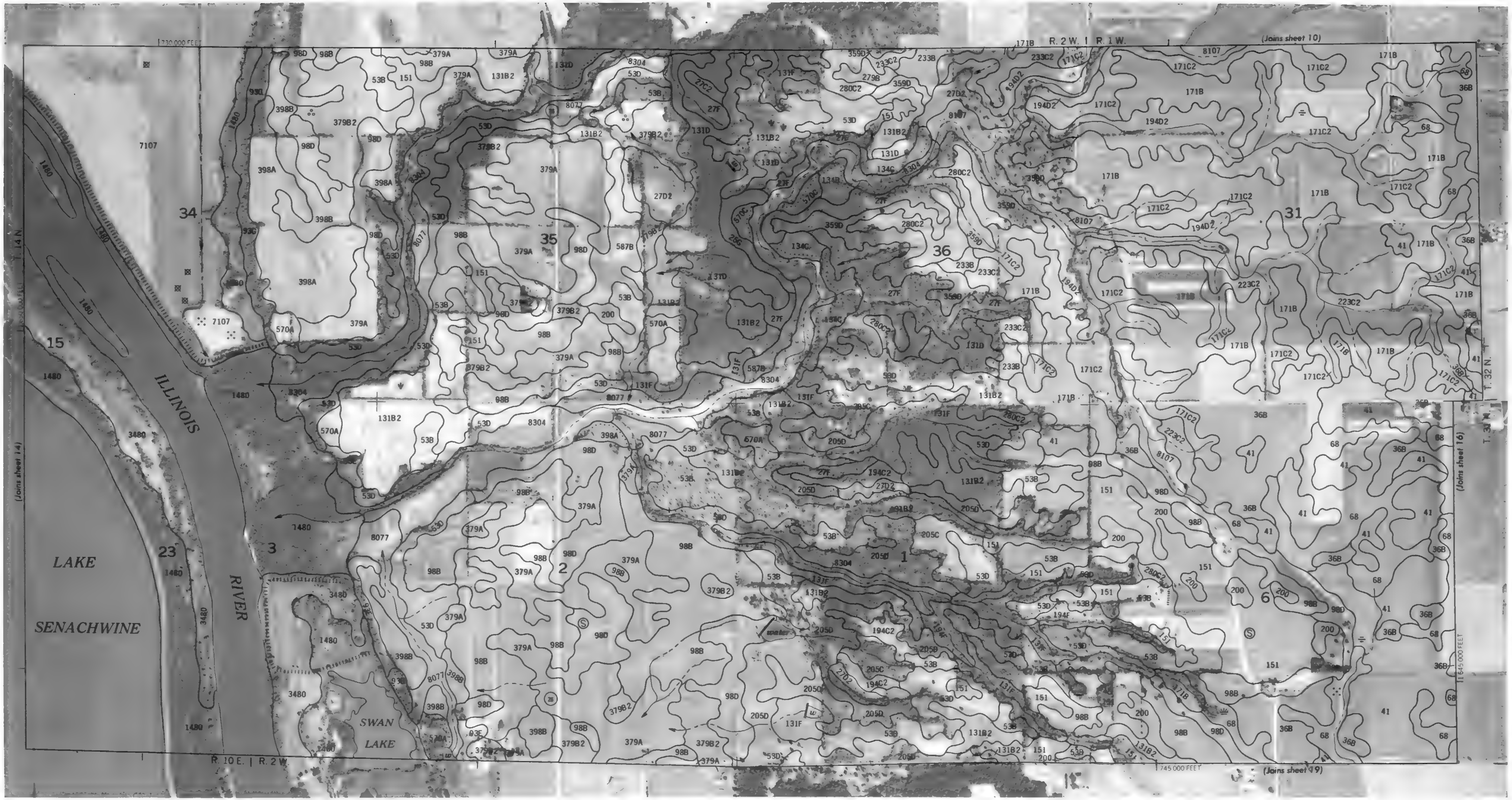
PUTNAM COUNTY, ILLINOIS NO. 14

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1979 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

N

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1979 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

PUTNAM COUNTY, ILLINOIS NO. 15

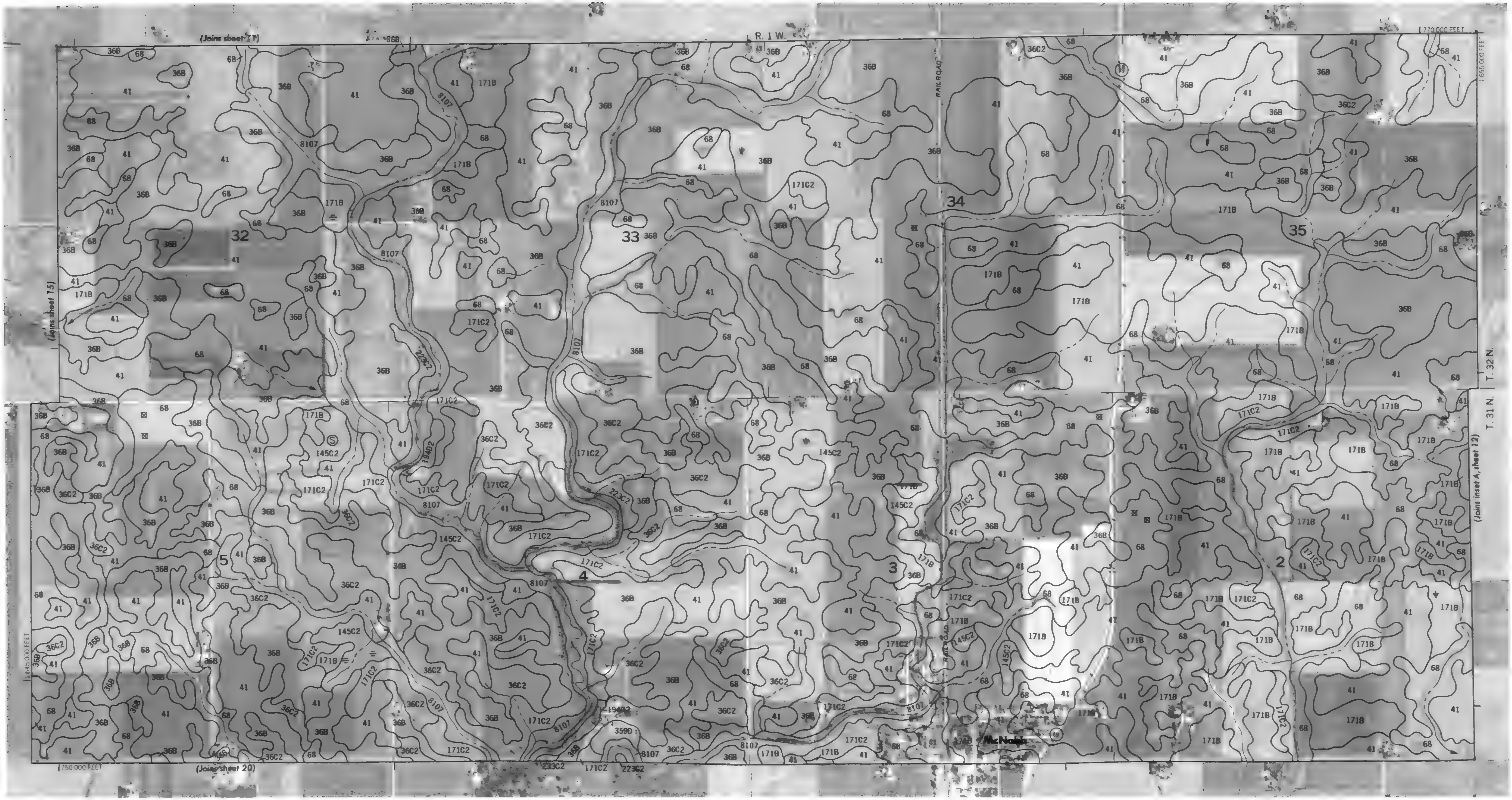


1 3/4 1/2 1/4 0 1 MILE

1 0.5 0 1 KILOMETER

SCALE 1:15 840

SOIL SURVEY OF PUTNAM COUNTY, ILLINOIS — SHEET NUMBER 16



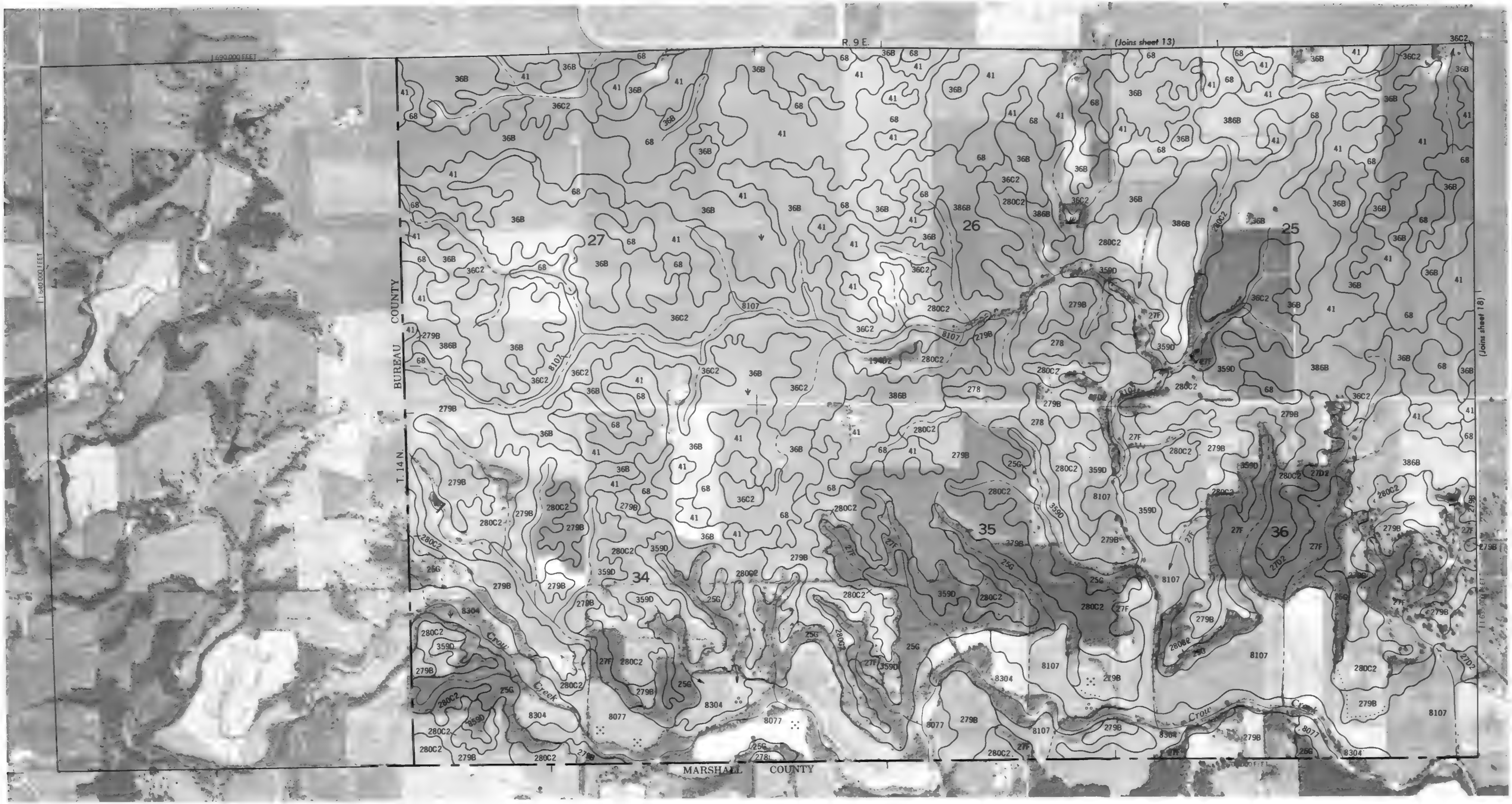
SCALE 1:15 840

PUTNAM COUNTY, ILLINOIS NO. 16

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1979 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

17

N



1 3/4 1/2 1/4 0 1 MILE

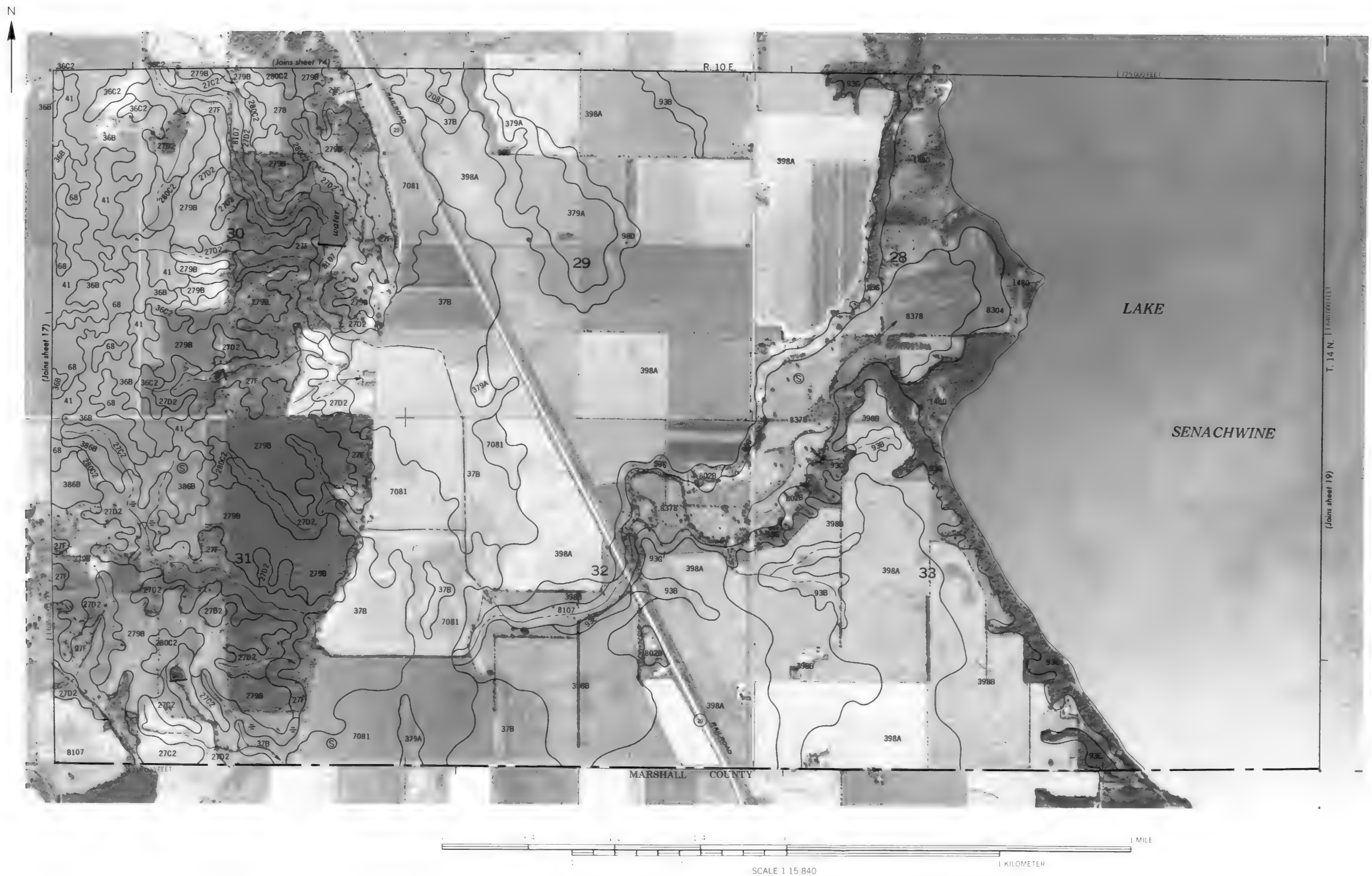
1 0.5 0 1 KILOMETER

SCALE 1:15 840

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1979 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

PUTNAM COUNTY, ILLINOIS NO. 17

18



PUTNAM COUNTY, ILLINOIS NO. 18

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1979 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1979 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

PUTNAM COUNTY, ILLINOIS NO. 19

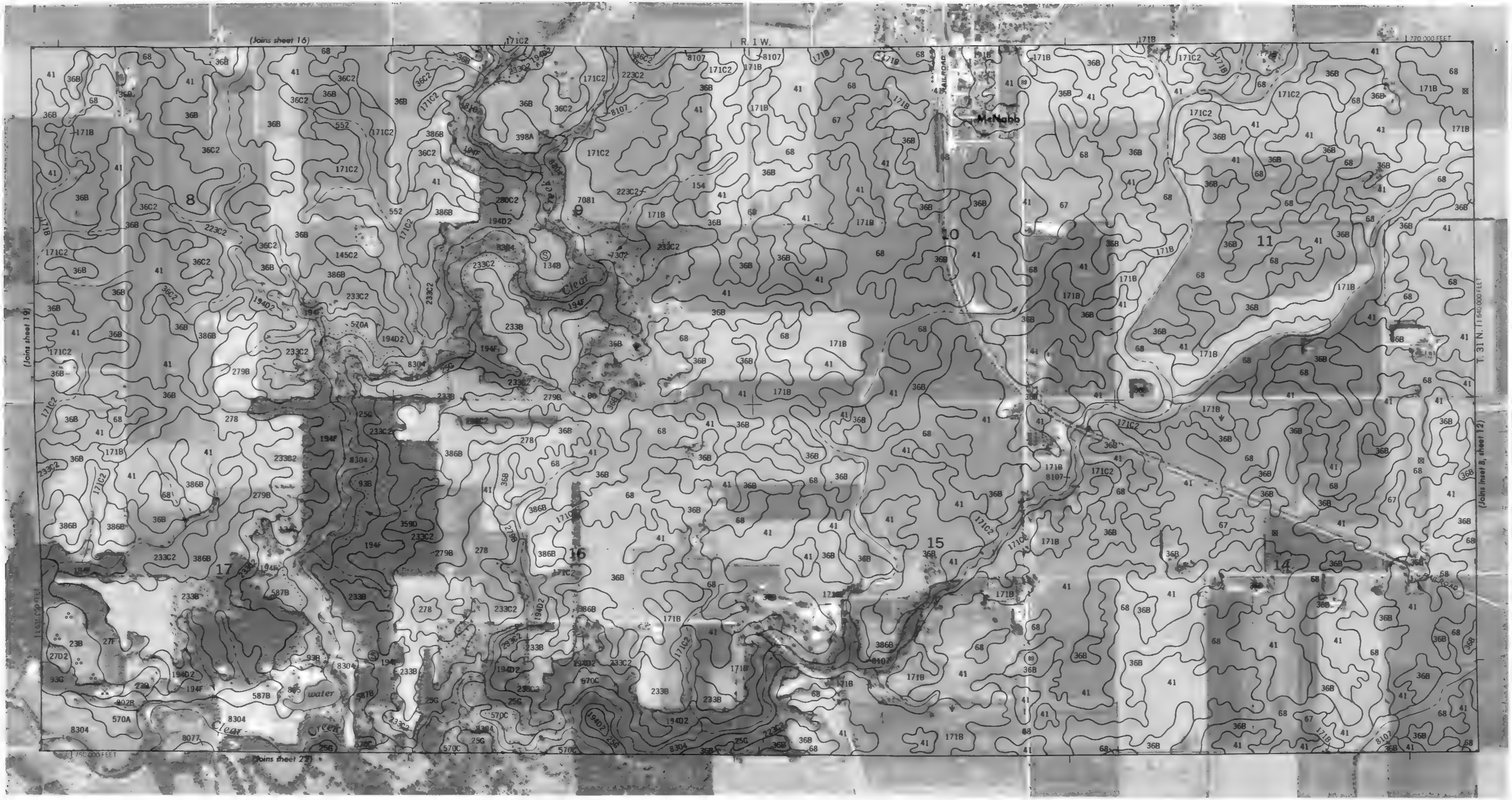
1 3/4 1/2 1/4 0 1 MILE

1 0.5 0 1 KILOMETER

SCALE 1:15 840

SOIL SURVEY OF PUTNAM COUNTY, ILLINOIS — SHEET NUMBER 20

N



3/4 1/2 1/4 0 1 MILE

1 0.5 0 1 KILOMETER

SCALE 1:15 840

PUTNAM COUNTY, ILLINOIS NO. 20

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1979 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

(21)

N

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1979 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

PUTNAM COUNTY, ILLINOIS NO. 21

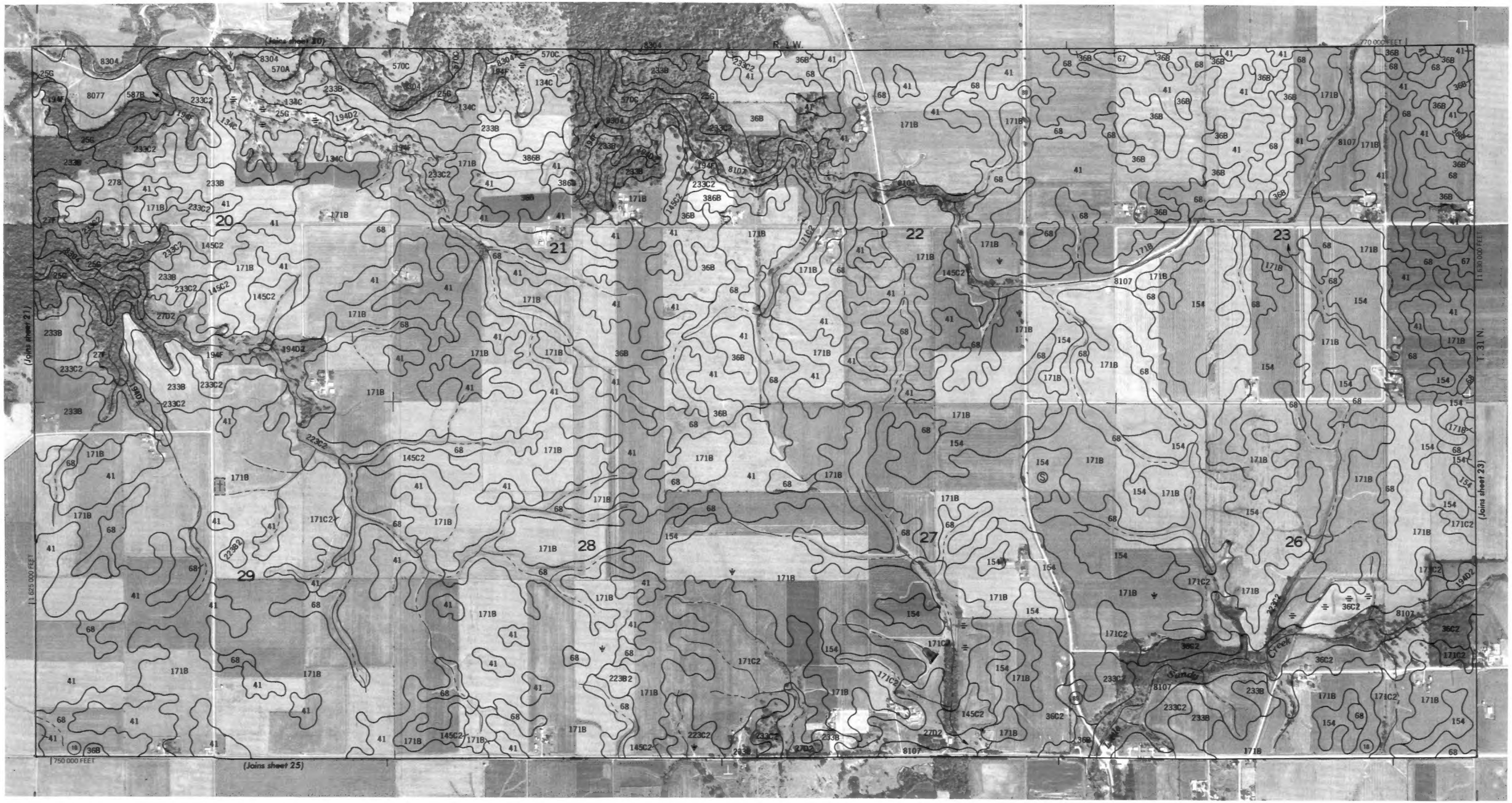
1 3/4 1/2 1/4 0 1 MILE

1 0.5 0 1 KILOMETER

SCALE 1:15 840

SOIL SURVEY OF PUTNAM COUNTY, ILLINOIS — SHEET NUMBER 22

N



1 3/4 1/2 1/4 0 1 MILE

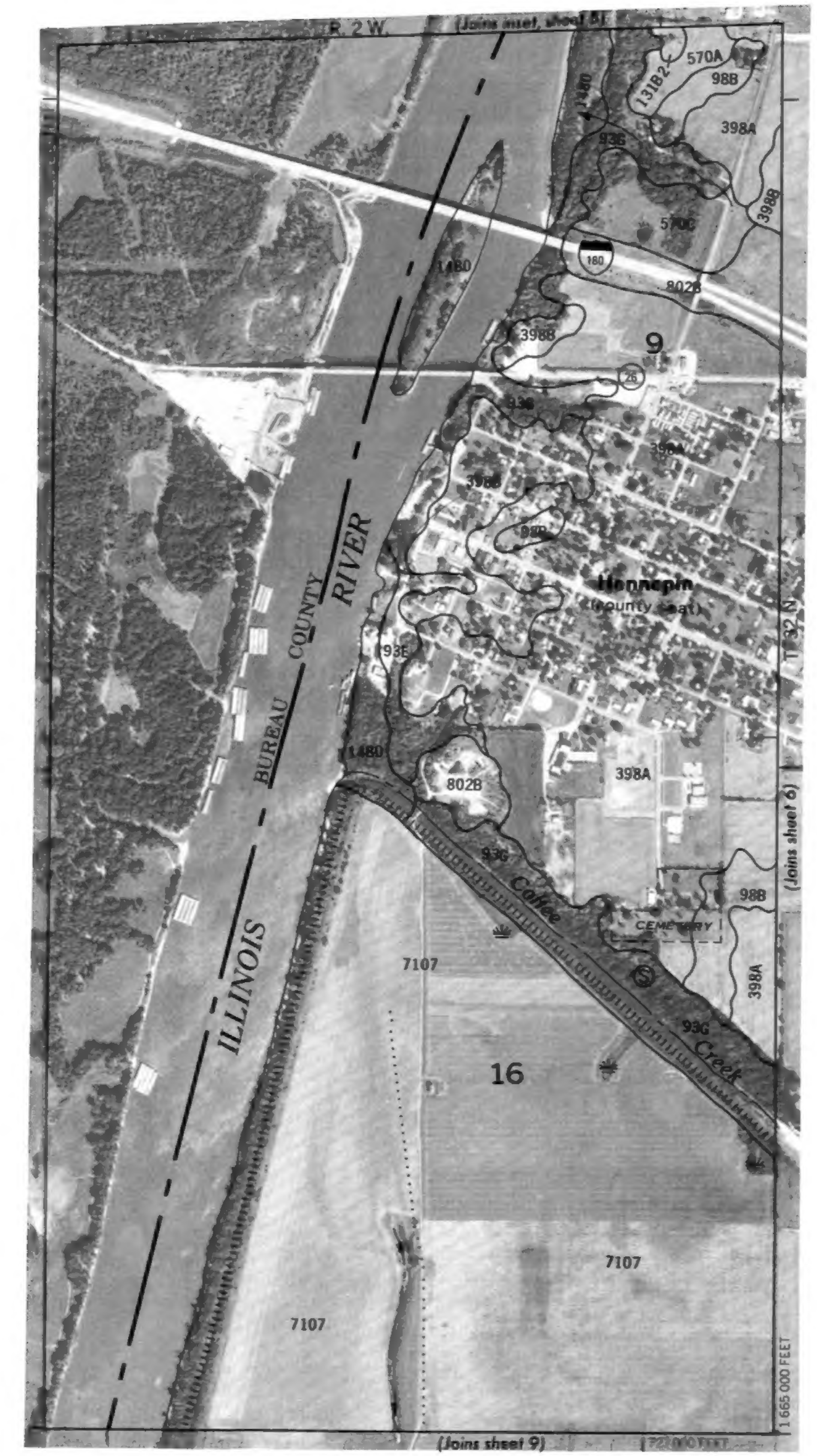
1 0.5 0 1 KILOMETER

SCALE 1:15 840

PUTNAM COUNTY, ILLINOIS NO. 22

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1979 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

N



1 3/4 1/2 1/4 0 1 MILE

1 0.5 0 1 KILOMETER

SCALE 1:15 840

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1979 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

PUTNAM COUNTY, ILLINOIS NO. 23

1 3/4 1/2 1/4 0 1 MILE

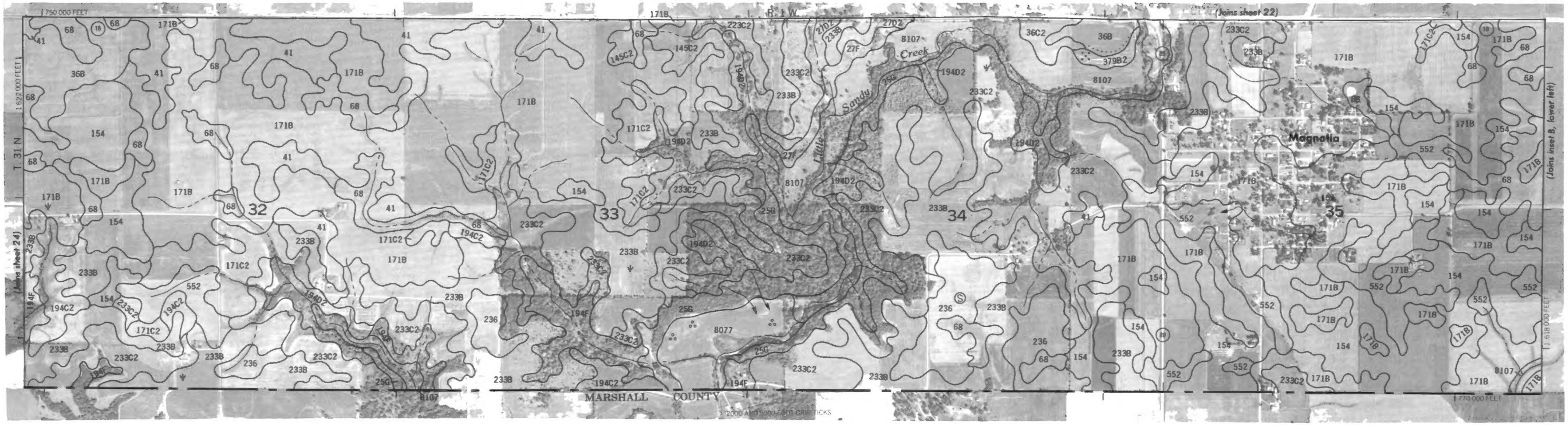
1 0.5 0 1 KILOMETER

SCALE 1:15 840

PUTNAM COUNTY, ILLINOIS NO. 24

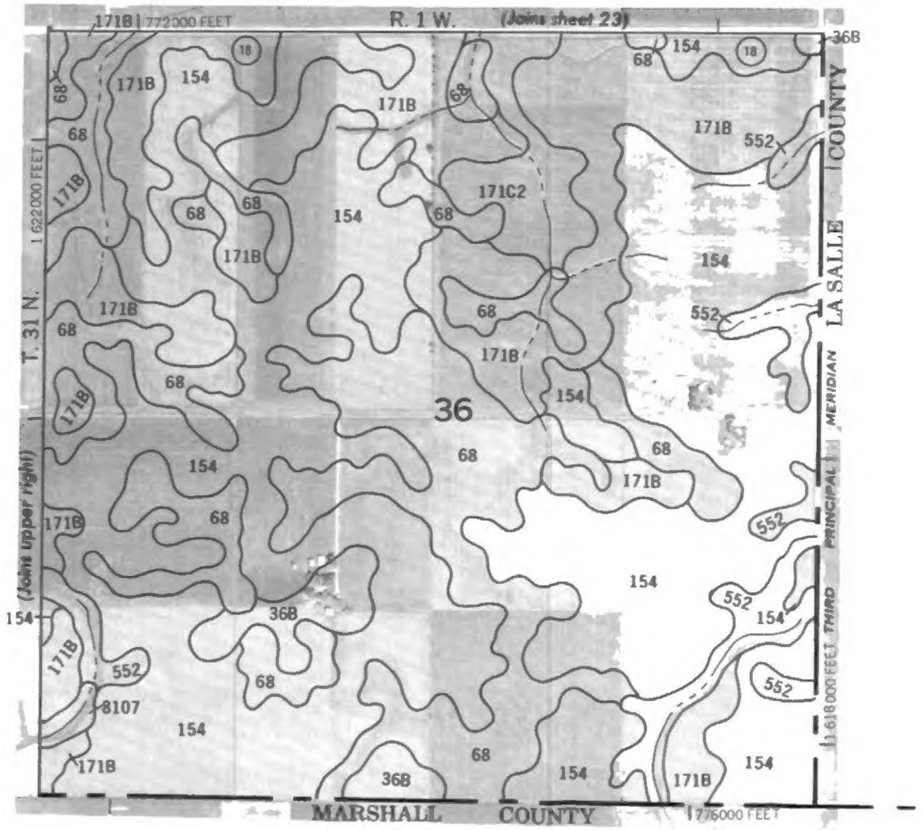
This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1979 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

N



INSET A

INSET B



1 3/4 1/2 1/4 0 1 MILE

1 0.5 0 1 KILOMETER

SCALE 1:15 840

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are prepared from 1979 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

PUTNAM COUNTY, ILLINOIS NO. 25